AMERICA'S AIR FORCE, THE FUTURE CALLS:

AN EVIDENTIARY AND THEORETICAL ANALYSIS OF THE ROLES AND MISSIONS OF A USAF ASTRONAUT CORPS

BY

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ABSTRACT

The United States Air Force failed in its early attempts to put Airmen into space during the late 1950s and early 1960s. The reason was simple; the service lacked a clear mission requirement for emplacing its personnel on orbit. The exorbitant cost outweighed the possible benefits of a manned military space program. This study attempts to answer the question of whether the strategic environment (to include current space policy, space strategy, the United States' space activities, other spacefaring actors' activities, and the natural environment) has changed such that the Air Force can now justify establishing its astronaut corps. Since the last attempts at building an Air Force astronaut corps, developments in commercial, civil, and military space activity suggest that the time has again come to consider the need for Airmen astronauts. While the strategic environment could necessitate cultivating an astronaut corps, the international political consequences may negate any advantage of doing so. Thus, this work also investigates the theory-based implications of a USAF astronaut corps, specifically within the roles of using astronauts as part of a space weapon system and within the context of a space police, or guardian, force.

The reality of the strategic environment coupled with spacepower theory intimate that USAF personnel would best serve the strategic interests of the United States in the role of space police. To that end, this study investigates two case studies involving American astronaut selection to glean insight from Project Mercury and the modern-day NASA astronaut force, which could be used in constructing a USAF astronaut force. The study's final section highlights the fact that current evidence is not sufficient to justify building a USAF astronaut corps. While the time has not yet arrived, the future is likely to change this conclusion. The question becomes one of timing. When should the USAF construct an astronaut corps? This work concludes with providing necessary conditions for the timing of building an astronaut corps and determines that such a decision will hinge upon the progress of commercial development in space. Ultimately, America's spacepower enhances national power. At some point, the USAF will need to cultivate an Airmen astronaut force to protect vital national interests in space. Today is the day it must prepare.

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Examining the Unknown

> *There is a tendency in our planning to confuse the unfamiliar with the improbable. The contingency we have not considered looks strange; what looks strange is thought improbable; what is improbable need not be considered seriously.*
>
> Thomas Schelling

Introduction

The United States has reaped the rewards of its hegemony and benefited from the enduring nature of Liberal institutions that it and other Western, liberal democracies helped foster following the Second World War.[1] While John Ikenberry asserts that the liberal democratic international order will endure with an American hegemony, Robert Gilpin's *War and Change in World Politics* suggests otherwise.[2] In some ways, the end of the Cold War has brought about stability; certainly, the fear of global thermonuclear war has subsided. Yet, in other ways, the international order appears less stable.

As America confronts the rising tumult in Syria, the strain on resources brought about by the wars in Iraq and Afghanistan has inhibited the nation from addressing all security challenges it faces. In part, the 2008 worldwide recession, anemic domestic growth, and the threat of another worldwide economic downturn have forced the country to evaluate strategic priorities in the light of fiscal reality. As Bernard Brodie astutely recognizes, strategy wears a dollar sign.[3] That revelation has weighed on the United States' ability to focus appropriate attention on space strategy partly because building such a strategy would have to include the "political, economic, scientific, military, environmental, and cooperative considerations" in order to have any chance of success.[4]

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1. G. John Ikenberry, *Liberal Leviathan: The Origins, Crisis, and Transformation of the American World Order,* (Princeton, NJ: Princeton University Press, 2012), 217-218.
2. Robert Gilpin, *War and Change in World Politics,* (Cambridge, England: Cambridge University Press, 1983), 288.
3. Bernard Brodie, *Strategy in the Missile Age,* (Santa Monica, CA: RAND Corporation, 2007), 369-388.
4. James J. Wirtz, "The Political Vacuum of Space and the Quest for Strategy," *Astropolitics* 8, (December 2010): 137.

Shaping grand strategy, however, is a craft of making tradeoffs in capabilities to buttress those areas believed to be the weakest. Priorities drive the zero-sum game for the strategist. The shifting of strategic priorities (from the Middle East to the Pacific) has cast the national space mission into the dark. Consequently, space strategy lacks an "overriding political objective" and focus.[5] This lack of focus is not surprising as James Wirtz states:

> When it comes to space, there is no threat or opportunity that captures the hearts and minds of policy makers and the public alike. Without this political motivation, there are no incentives to order priorities, manage trade-offs, or allocate resources. Adding injury to insult, however, is the fact that the whole issue of resources becomes highly problematic in the absence of a discernible political motivation behind US space strategy. Space programs, be they military, manned, or scientific, have a weak constituency, especially in comparison to the issues of immediate political importance to the vast majority of terrestrials, i.e., voters.[6]

The American public, and hence political leadership, find little political impetus for developing space strategy. The lack of political impetus may explain why, as Robie I. Samanta Roy notes, no current or emerging space actor has constructed a "national comprehensive space strategy."[7] In other words, the United States' articulation of space policy and the assorted strategic aims has lacked "connectivity in the general hierarchy of policy, strategy, and plans" among the various national agencies.[8] The 2011 National Security Space Strategy was a start, as were earlier iterations in 1984 and 2004. Yet, even the current strategic documents lack the comprehensiveness of an overarching grand national space strategy.[9] In other words, none of these attempts produced a whole-of-government approach to space; they were either narrowly

5. Wirtz, "The Political Vacuum of Space and the Quest for Strategy," 137.
6. Wirtz, "The Political Vacuum of Space and the Quest for Strategy," 137-138.
7. Robie I. Samanta Roy, "Political Challenges of Space Strategy," in *Space Strategy in the 21st Century: Theory and Policy*, ed. Eligar Sadeh (New York, NY: Routledge, 2012), 42-43. While exploring the development of United States space strategy, Roy determined that few other nations had developed a strategy. Despite the United Kingdom and Canada having developed strategies, she asserts that it is not clear that these documents exert any certifiable influence on the respective national governments.
8. Roy, "Political Challenges of Space Strategy," 39-50.
9. Roy, "Political Challenges of Space Strategy," 42.

defined towards securing reliable transportation to space as in the Reagan Administration's National Security Decision Directive 144, or never were published as in the case of President George W. Bush.[10] Put bluntly, the United States lacks a comprehensive space strategy.

The lack of a strategy, however, has not negated threats to American freedom of maneuver in space. Continuing upon a path unanchored by strategy is unlikely to lead to continued prosperity. Perchance, the lack of strategy is intentional. Carl von Clausewitz is well-known for his trinity embodied in the government, military, and the people as well as for stating that "war is an act of policy" and "a continuation of political intercourse, carried on with other means."[11] Equally important, Clausewitz asserted that at the highest levels of war, war itself turns into policy, hence, it is false to think "policy could make demands on [strategy] which [strategy] could not fulfill…that hypothesis would challenge the natural and unavoidable assumption that policy knows the instrument it means to use."[12] In other words, if policy knows that space strategy will not achieve the intended means, then the lack of a space strategy aligns with national policy on space in a vacuous manner. Moreover, such a confluence aligns well with Clausewitzian thought.

Such a conclusion, however, ignores the critical supposition in Clausewitz's assertion. Policy must read "the course of military events correctly."[13] Having done so, policy is "wholly and exclusively entitled" to decide the course of strategy with political aims as the destination.

Thesis Statement

Policy, however, has not read "the course of military events correctly," at least in space.[14] The American government has sought to "unify and reconcile all aspects" of government concerning the nation's role in space but has

10. "National Security Decision Directive 144, National Space Strategy, 16 Aug 1984," George Marshall Institute, 1984, Accessed 28 December 2015, http://marshall.wpengine.com/wp-content/uploads/2013/09/NSDD-144-National-Space-Strategy-16-Aug-1984.pdf. 1-6; Roy, "Political Challenges of Space Strategy," 42.
11. Carl von Clausewitz, *On War,* Reprint ed. trans. Michael Howard and Peter Paret (Princeton, NJ: Princeton University Press, 1989), 86-87.
12. Clausewitz, *On War,* 607.
13. Clausewitz, *On War,* 607.
14. Clausewitz, *On War,* 607.

neglected to develop a true grand space strategy.[15] Accordingly, national leadership has not taken the "one [stand]point yield[ing] an integrated view of all phenomena."[16]

The grand strategic picture is incomplete without proper consideration of space. A national space strategy is needed. Developing such a strategy, however, is beyond the scope of this study. Nevertheless, there may be actions the United States Air Force can take to support any such national space strategy especially since the service bears the responsibility of managing the space functional component of national security.[17] This treatise will explore how the USAF can posture for the future by examining the endogenous and exogenous factors influencing the need, or lack thereof, for a wholly USAF astronaut corps.

The intent: appraise the plausibility of manned military missions in general, and a USAF astronaut corps in particular, within the context of policy, strategy, extant strategic influences, and theory-based considerations. The examination will bring to light the course of strategic events so that policy may read the course correctly. As a by-product of this investigation, this work will also cast light upon how the USAF can support a future national space strategy. In other words, this paper will answer the question of whether or not the USAF needs its own astronaut corps (separate and distinct from that of the National Aeronautics and Space Administration [NASA]), and by doing so will raise some issues that will likely require addressing as space strategy development continues. This work, however, will not develop the holistic strategy to which Wirtz alluded. It is a preliminary measure.

One aspect of this preliminary measure is the examination of future space force structure. Many strategists accept the tenet that strategy must precede force structuring; military and national leaders prove wise when structuring their forces for a desired strategy rather than shaping strategy based on the extant force. British military theorist J.F.C. Fuller delineated such a theorem in his systematic development of military theory. From

15. Clausewitz, *On War,* 606.
16. Clausewitz, *On War,* 606.
17. Department of Defense (DOD) Directive 5101.02e, *DOD Executive Agent for Space,* 25 January 2013.

ascertaining the aim of military action, senior military leadership may then seek out those aims through the structure, planning, and expenditure of the military.[18] "By this chief consideration the whole course of the war is prescribed, the extent of the means and the measure of energy are determined; its influence manifests itself down to the smallest organ of action."[19]

Colloquially, political aims and strategy are the horse and the military is the cart. In seeking Fuller's "more prosperous peace," a nation must sense the transformative forces at play in the international order. The nation must understand the cause of these forces and the magnitude of their effects so that the means for achieving a better peace, military force, may be redistributed economically.[20] While Fuller spoke on the economy of force within the context of armed conflict, there is a certain truism in his assessment that extrapolates to the full continuum of war including preparation for the potentiality of future conflict. A nation must build the perfect "grand-strategical machine" to accomplish the aims for which military endeavor began.[21]

Having established the logic of subordinating military force structure to strategy, the reader should consider, rather paradoxically, a contrarian viewpoint. If a nation's resources are the vital blood in the arteries connecting the heart that is policy and military strategy, the body, then without adequate sustenance, both die, and the aims remain unmet. The strategist, however, may resuscitate political aims by advocating for strategy's necessary resources. Simultaneously, he must admit when military strategy cannot achieve a nation's aims. The strategist must help national leaders avoid influencing operations for the worse when they are tempted to "look to certain military moves…for effects foreign to their nature."[22] Military force must be subordinate to policy; it is an essential trait of the American constitutional system. However, Clausewitz admitted that the political aim is not a tyrant; successful policy should "adapt itself to its chosen means."[23] While policy converts the

18. J. F. C. Fuller, *The Foundations of the Science of War,* (Coconut Creek, FL: Books Express Publishing, 2012), 112.
19. Fuller, *The Foundations of the Science of War,* 106.
20. Fuller, *The Foundations of the Science of War,* 214-215.
21. Fuller, *The Foundations of the Science of War,* 107.
22. Clausewitz, *On War,* 608.
23. Clausewitz, *On War,* 87, 607.

"terrible battle-sword" of war into a "light, handy rapier," there are times when policymakers lack awareness of the necessity of such a blade.[24] The strategist may provide insight on the advisability of wielding such an instrument of power.Accordingly, this treatise purposes to investigate the duel in space and elucidate the changing environment both terrestrially and celestially that may necessitate the forging of a new rapier. Beyond just answering the question of whether the USAF requires an independent astronaut corps, the treatise will afford itself the opportunity to set the stage for building a national space strategy through discussion of factors which may merit such an endeavor.

Intended Audience

The construction of an astronaut corps will fall upon heterogeneous engineers, should the decision be made to pursue such an endeavor. However, it will be the USAF's most senior civilian and uniformed officer who must consider, and then advocate for, this study's findings before the other services and Congress.[25] Consequently, the other armed services and Congress, are also intended audiences. While the paper addresses space-related policy, missions, and capabilities that have, largely heretofore, rested upon the USAF, these same areas inherently impact the entire nation. Congress and the other services must understand the issues that drive developing a separate USAF astronaut corps given their respective responsibilities as the appropriation authority for military expenditure, and as co-vanguards with the USAF in defending the nation and competitors for funding. As some scholars argue, the United States is now a spacefaring nation.[26] Consequently, it is in the country's self-interest to examine the existing problems facing the nation in space. Even the highest echelons of the executive branch, to include the Secretary of Defense and White House, are intended audiences of this tome.

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24. Clausewitz, *On War,* 606.
25. For an explanation of what a heterogeneous engineer is, see Donald Mackenzie, *Inventing Accuracy: A Historical Sociology of Nuclear Missile Guidance,* Reprint ed. (Cambridge, MA: The MIT Press, 1993), 85-91.
26. Randy Gordon, "The Landmark Space Age Thucydides: Human Spaceflight in the State's Grand Strategic Quest to Address Fears, Advance Interests, and Garner Honor" (M.A. thesis, Air University, June 2011), ; Martin J. Collins, and Sylvia D. Fries, eds. *SPACEFARING NATION* (Washington, DC: Smithsonian, 1991), 245.

Other audiences who may find this thesis fruitful are the space policy scholars as well as those who execute space policy, the practitioners. Additionally, the policy advocate and space activist will find these musings useful because the study highlights the current and future operational environment. Finally, this thesis is intended for the American citizen who benefits from the idea that space is a global commons. "Global commons are areas that no one country has sovereignty over and its resources can be used by all, or, at least by those who have the technological capabilities to explore those resources."[27] The global commons of space is not closed, but it is threatened by states competing in a system motivated by self-interest and maximization of security.[28] By understanding the threat to the global commons, the American populace can solicit their representatives to either protect the American piece of the pie or advocate for better international protections of the global commons through binding international law. Naturally, this call to protect the global commons raises the question of who will protect them. This work will attempt to offer one possible answer.

Terminology

As previously mentioned, the purpose of this thesis is to address the current and future space environment as it pertains to national security and the role of the USAF within that environment. Furthermore, it intends to assess whether a separate USAF astronaut corps is necessary to meet the strategic aims of the United States. It is important then, to understand what is meant by astronaut in order to address a likely critique of this thesis. The potential critique: NASA already has astronauts, so why spend money on a duplicative endeavor in increasingly austere times?

NASA defines the term "astronaut" as those pilots, engineers, specialists, and mission commanders whom NASA selected to become, in a nod to the

27. Lisa Domme, "Space and the Global Commons," CSIS.org, 16 April 2010, Accessed 6 January 2016, http://csis.org/blog/space-and-global-commons.
28. Aljosa Noga, "The Tragedy of Outer Space as a Global Commons and Public International Law: An Analysis of the Law Governing Outer Space and Its Compatibility With Behavioral Economic Models on Resource Extraction" (M.Phil. thesis, Örebro University, 2014), 13.

Greek etymology, a professional "space sailor."[29] In other words, these astronauts are the space explorers, the scientists, and maybe even the adventure seekers.

Conversely, in this thesis, astronaut connotes more than a "space sailor." Instead, the type of astronaut that this work posits is similar to the mission-ready pilot, only the pilot's Mission Design Series is not capped by the tropopause. The USAF astronaut may also be the equivalent of the current pararescue operator or even a Buck Rogers-like space soldier. In attempting to codify the term, there is some ambiguity smuggled in because this thesis not only asks whether such a force should exist, but if so, what should it look like. Already, the author admits that replicating the NASA astronaut corps is not the answer to the issues facing the United States. As this paper develops, the term astronaut will take on various meanings, but as it pertains to the question at hand, the definition is not synonymous with NASA's astronaut.

Hypothesis

It is with a sense of humility that the author approaches this topic. Formulating space policy and strategy is not a simple task. Structuring a military force to implement said strategy is also difficult. Some of these difficulties in formulating strategy and structuring military force may lie in the fact that envisioning war in space is challenging; its character is fundamentally different from war in other operating environments.[30]

Yet, the USAF must envision what the future of space could be. Already, the strategic environment in space is changing rapidly. Thus, a discussion of the merits of an independent USAF astronaut corps is warranted. Having a discussion, however, may not imply action. Despite the changing environment, the author does not sense that the time is nigh to create a separate USAF astronaut corps. That is, this work presents the following null hypothesis:

29. "About Astronauts," NASA, 3 November 2015, Accessed 6 January 2016, http://www.jsc.nasa.gov/Bios/.
30. Todd Harrison, "The Surprising Ways the U.S. Would Fight a War in Space," *Forbes,* 8 June 2015, http://www.forbes.com/sites/toddharrison/2015/06/08/how-would-a-war-in-space-be-fought.

Hypothesis: The United States Air Force does not require a separate astronaut corps.

Notice that the supposition does not state that the USAF will never need an independent astronaut corps. The conditions, instead, do not warrant one at this time. Such a qualification is due to the necessary investment of national resources and the likely reaction of other nation-states. The future may require the construction of a military astronaut corps, but as of this writing, a current requirement does not exist. Nevertheless, the author will examine assumptions and, in the words of Sir Basil Liddell Hart, leaders and policy-makers will better grasp grand strategy vis-a-vis space and develop "a farsighted regard to the state of the peace that will follow" as a result of introspection.[31] Contrary to Fuller, however, the author does not posit that the United States suffers military shortsightedness due to the worship of traditions or that policymakers do not see "world forces in their true relationship."[32] Instead, because of the confluence of current conflict and budgetary quandaries needing to be solved to support the Combatant Commander, the nation may lose sight of the horizon and what looms beyond it. Asking whether the USAF and, indeed, the nation, need a military astronaut corps prepares the nation for eventualities as well as potentialities.

Methodology

In establishing an argument for the hypothesis, the author intends to examine current unclassified space missions, both military and civilian, that either require a manned presence for effectiveness or could possibly require one. Specifically, the author will look at USAF and US military doctrine as well as private company mission statements to gain insight on the possibilities of the future.

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31. B. H. Liddell Hart, *Strategy,* 2nd revised ed. (New York, NY: Meridian, 1991), 220.
32. Fuller, *The Foundations of the Science of War,* 31. Compare this comment to the author's earlier comment that policymakers do not see the "the course of military events correctly" concerning space. These two observations may seem contradictory, but they are not. Reacting to current world forces (i.e. the relationship between American ideals and extremist ideology) has led to the loss of focus on the strategic reality of space. Thus, both of the author's comments are compatible.

Using these sources as a starting point, the author will then use the expert opinions and insight from personnel in the fields of commercial space tourism and spacelift, as well as the USAF's own space professionals, to ascertain whether humans need to perform those future missions. The author will also look at NASA source documents, including personal interviews, oral histories, and technical papers on manned spaceflight as well as current and future space missions, and compare these sources to USAF documentation to determine whether a national capabilities gap exists.

After demonstrating that a capabilities gap exists, the author will then investigate whether USAF astronauts could fill that gap. By studying Project Mercury and modern NASA astronauts, and primary sources from NASA's Johnson Space Center, this paper will propose the type of astronaut corps the USAF should consider building.

The Literature

Despite the broad base of evidence this work will draw upon to test the hypothesis, there is actually a paucity of literature dealing directly with the question of military personnel in space. While much was written on NASA's endeavors in manned spaceflight, relevant literature for similar military programs only covers the 1960s and before. This lapse is for good reason, as following the cancellation of such programs as the Manned Orbital Laboratory and Project Dyna-Soar, the military in general, and the USAF specifically, no longer pursued independent manned excursions into space.[33]

Instead, looking at literature discussing space policy, space strategy, the commercialization and colonization of space, and military doctrine provides the

33. Dwayne Day, "All Alone in the Night: The Manned Orbiting Laboratory Emerges From the Shadows," The Space Review.com, 23 June 2014, http://www.thespacereview.com/article/2539/1. ; "Boeing: Historical Snapshot: X-20 Dyna-Soar Space Vehicle," Boeing.com, 2016, http://www.boeing.com/history/products/x-20-dyna-soar.page. The Department of Defense and NASA conducted 11 missions as part of the National Security Space program. The Defense Department and NASA conducted various classified missions, including deploying multiple satellites. The USAF trained 27 payload specialists for this joint venture; however, only two flew on actual missions. Ultimately, the USAF cancelled the program because it determined that unmanned transport systems were a more cost-effective manner for putting payloads onto orbit. See Jeff DeTroye, *et al.*, "National Security," in *Wings in Orbit* (Houston, TX: NASA, 2011), 42-51.

proper perspective to then begin an analysis of the proposed problem statement.

Nathan Goldman, attorney and adjunct professor at Rice University, in *Space Policy: An Introduction*, wrote one of the first introductory, but nevertheless comprehensive pieces on space policy. In this book, Goldman explores the history of space policy systematically by examining first the advent of spaceflight and shows that the dream of spaceflight had always been a multinational phenomenon. Furthermore, the fulfillment of putting humans in space was truly a multinational accomplishment.[34] The accomplishment possessed a multinational character, in part, because of competition between the Soviet Union and the United States.[35] As a result of this competition, American perceptions about the "importance of space for foreign affairs and for the domestic economy" matured, giving rise to clearer American space policy.[36] After this brief depiction of spaceflight history, Goldman uses his model of space policy formulation, as shown in Figure 1, to lead the reader through the input-to-conversion-to-output feedback loop that he asserts demonstrates how space policy is determined.

34. Nathan C. Goldman, *Space Policy: An Introduction,* (Ames, IA: Iowa State Press, 1992), 3-13.
35. Goldman, *Space Policy: An Introduction,* 3-13.
36. Goldman, *Space Policy: An Introduction,* 15.

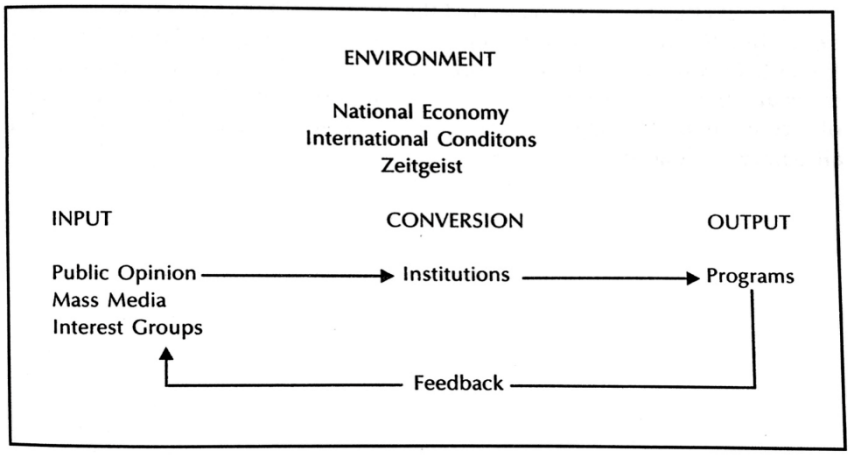

Figure 1. Goldman's Systems Diagram of Space Policy

Source: Nathan C. Goldman, Space Policy: An Introduction

Goldman's book was written in 1992 and does not capture the last 24 years of space policy development, but his heuristic model for policy formulation as well as his conclusion that the United States lacks "consistent high-level and coherent policy," still exhibit validity.[37] Goldman's treatment of advances in private innovation in space, as well as his look at the militarization of space, provide a scaffolding upon which space strategy may be laid. Finally, his examination of the factors influencing policy provides the strategist a method for looking for solutions to potential problems policy identifies.

Where Goldman's book looked broadly at civilian and military developments and how they influence space policy, John S. Lewis', *Mining the Sky*, focuses sharply on the commercialization of space. Additionally, Lewis advocates for the whole of government to "lift up [its] eyes and look at the wealth of energy and materials that surround us in space."[38] Written in 1996, while serving as Commissioner of the Arizona Space Agency, Lewis builds the case for extraterrestrial exploration both in the pursuit of capital gain and to ameliorate the problems caused by limited resources and population growth on Earth. While much of Lewis' argument hinges on 1990s technology and requires a futurist outlook towards technological progress, Lewis now stands

37. Goldman, *Space Policy: An Introduction,* 251.
38. John S. Lewis, *Mining the Sky: Untold Riches from the Asteroids, Comets, and Planets,* (Reading, MA: Helix Books, 1996), xi.

prescient in his assessment of the incredible potential for harnessing solar power from space rather than Earth, and his argument for mining asteroids is nearly a reality.[39] The reason that Lewis' work is important is that he paints for humanity, a near-limitless, resource rich, landscape to behold. The untapped potential is also an untapped well for human conflict concerning control of those resources and raises the question of whether nations will need to defend property rights in space as they do on Earth.

Whether the United States will adopt a policy that protects the property rights of its citizenry in space remains unanswered. Yet, Lewis' ideas come into sharper relief in light of the article, "The Dilemma of Space Strategy: What is the Intent?" penned by Joan Johnson-Freese, professor of national security affairs at the US Naval War College. As the title of the article suggests, Johnson-Freese examines the intent of developing a space strategy.[40] She asks if strategy will address commercial and private interests in space, of if strategy will turn a blind eye to the emerging developments in the United States and globally. Without answering these questions, Johnson-Freese offers an interesting conclusion.

> The mere process of trying to determine the fundamentals of a comprehensive space strategy is worth the effort. The success or failure of such an effort will largely be determined by who is part of the process, and whether each stakeholder has a vested interest in the success of the process. While it may well be that the entirety of the strategy cannot be executed immediately, if it allows all relevant communities to interact, the communities as a group get closer to agreeing on clear goals, and it provides an incremental roadmap. These outcomes are valuable steps forward.[41]

The journey in building a strategy provides a direction and vector for future American endeavors in space and provides a proving ground to foster critical thought among the next generation of strategists.[42]

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39. Lewis, *Mining the Sky: Untold Riches from the Asteroids, Comets, and Planets,* 225-227, 193-199; "Space Solar Power: Limitless Clean Energy From Space," NSS.com, 2016, Accessed 13 January 2016, http://www.nss.org/settlement/ssp/.
40. Joan Johnson-Freese, "The Dilemma of Space Strategy: What is the Intent," *Astropolitics* 8, (December 2010): 144.
41. Johnson-Freese, "The Dilemma of Space Strategy: What is the Intent," 144.
42. Johnson-Freese, "The Dilemma of Space Strategy: What is the Intent," 144-145.

Finally, if Goldman's systems model of policy were put to practice, then Lewis' need to obtain and protect extraterrestrial resources would comprise an input while space strategy would be an outcome of the policy process (albeit Goldman does not explicitly state as much). Another output would be a manned, military space program. One such program was the focus of Roy Houchin, professor of strategy at the USAF Air War College, in *US Hypersonic Research and Development: The Rise and Fall of Dyna-Soar, (1944-1963)*. Against the backdrop of the Dyna-Soar program, Houchin highlights how the program's struggles entailed more than a fight for scarce resources; there was also a fight, and admittedly a losing one at that, for the USAF to keep its astronaut force.[43] For Houchin, the Dyna-Soar program emphasized the considerable political gravity the USAF had to overcome to put its own astronauts into space. Eisenhower's "space-for-peace" policy carried considerable mass, hence gravity, ultimately leading to the Dyna-Soar's demise.[44] The same political considerations that burdened Dyna-Soar will weigh upon the USAF should it decide to build an astronauts corps. Any future attempts will encounter over 50 years of inertia and tradition found in NASA's role as the sole manned spaceflight organization for the United States. Hence, Houchin's book is instructive as it illuminates some obstacles that could clutter the path to an Air Force astronaut force.

Scope

In order to limit its scope, this thesis did not examine all the potential roles and missions of a military astronaut. Rather, the author chose the most likely roles based on current and future space missions, including military, civil, and commercial, that could merit sending Airmen to space. Additionally, while space policy and space strategy are topics worthy of considerable discussion, the author will only give them cursory discussions as both fields are ever-changing and require dedicated focus unto themselves. Instead, the lessons and revelations from this thesis will raise questions of relevance to

43. Roy F. Houchin, II, *The Rise and Fall of Dyna-Soar, 1944-1963,* (New York, NY: Routledge, 2006), 78-79.
44. Houchin, *The Rise and Fall of Dyna-Soar, 1944-1963,* 77-79.

policy and strategy, but any recommendations contained herein will remain narrowly constrained to the issue of USAF astronauts.

Concerning methodology, the author excluded many historical cases regarding astronaut selection. First, borrowing from the design of experiment methodology, the author selected only the Project Mercury astronauts and the current corps of active astronauts as population samples. The author chose these groups, in part, because there may be valuable lessons from America's first astronauts, and using modern-day astronauts provides a contemporary comparison useful for determining how the USAF should create an astronaut force. Scoping the study in this fashion sacrificed sample size but avoided the problem of collinearity between the independent variables (in this case, the two samples of astronaut groups).[45] Obviously, less can be said about the broader population of astronauts when selecting small samples; however, the author wanted to deduce patterns and characteristics of each astronaut group without having non-empty intersections between the two sets. In other words, the author wanted to isolate the characteristics, as much as possible, to each subsample without carryover of common elements between each subsample.

Second, the author noticeably left out foreign astronaut programs. The author made this choice for two reasons. First, and most practically, garnering access to foreign space agencies is not an easy task and requires extensive language skills in Russian and Chinese. Second, while there is likely a universal set of human personality traits and technical skills that all astronauts share in common, this thesis is interested in the future possibility of a USAF astronaut corps, hence looking at American astronauts can isolate for cultural influences that are non-existent in other countries.

Limitations

In ascertaining the necessity of a USAF astronaut corps, this study was limited in terms of access to information on extant space programs. By keeping this thesis unclassified and releasable to the general public there is an entire

45. Ned Kock and Gary S. Lynn, "Lateral Collinearity and Misleading Results in Variance-Based SEM: An Illustration and Recommendations," *Journal of the Association of Information Systems* 13(7), no. 7 (July 2012): 546.

panoply of US military missions, current and planned, that could not be considered in the analysis of this study's hypothesis.

Organization

The organization of this work will take the reader from an understanding of the current space landscape to an analysis of the validity of the claim that the USAF does not yet need an astronaut corps of its own and resulting conclusions and recommendations.

In chapter 2, the author will paint a Georges Seurat-like painting.[46] The work will first observe the overall picture constituted by the current space environment and the influences of policy and strategy in order to bound the problem. Then, the work will focus on the fine details, the points, of existing, planned, and potential space endeavors inside and outside of the US government.

In chapter 3, the author will arrange the fine dots used as evidence in chapter 2 into a different chromatic grouping in order to use international relations and spacepower theories to analyze the validity of fielding a USAF astronaut corps. The author will use two analytical lenses through which to view the picture, namely Realism and Liberalism, to test the logical outworkings of this work's hypothesis. The author's theory-based analysis should offer insight on the roles astronaut Airmen could fulfill.

Next, in chapter 4, the author will examine two case studies on astronaut selection. By looking at the Project Mercury and current NASA astronauts, the author will try to codify general characteristics about these groups of individuals that led to their selection and success as astronauts. With these data, the work will then present what the author believes to be the necessary qualities of any future USAF astronaut corps.

In the concluding fifth chapter, the author will present this study's findings, and will accept or reject the null hypothesis based on the evidence the

46. Georges Seurat was a post-impressionistic painter well-known for the style of painting known as pointillism whereby painters painted individual dots to form an overall picture when observed in aggregate. His most-famous example: *A Sunday on La Grande Jatte.* See "A Sunday on La Grande Jatte — 1884," The Art Institute of Chicago, 2016, Accessed 5 May 2016, http://www.artic.edu/aic/collections/artwork/27992.

data provide. Finally, the author will discuss policy implications to the USAF leadership as well as recommendations for future studies based on the results of this work.

Chapter 2

One Large Step for Humankind: Evidentiary-Based Implications of an Air Force Astronaut Corps

There are two main causes for this military shortsightedness: the first is the worship of traditions, and the second is our incapacity to see world forces in their true relationship.

J.F.C. Fuller

Introduction

In testing the hypothesis laid out in the previous chapter, the author now addresses the context within which the United States operates. Contextual reality matters. The reality of the environment, or an actor's perception of said reality, provides the foundation upon which ideas are constructed that eventually birth action. For the strategist, the physical environment is where the ideas of policy bridge into operational execution.

The material reality of the space environment is, in some sense, a constant. The harshness of the vacuum of space, comprised of unrelenting radiation and extremes of temperature, does not sustain life. To understand the reality, which undergirds United States operations in space, however, one must look at the ideas found in policy and strategy. While the international environment exhibits facets of materialism, in that the distribution of resources affects state interactions, the current order is largely caused and constituted by ideas much as Alexander Wendt suggests in *Social Theory of International Politics*.[1] It is not far-fetched to assert that the American-Soviet space race was a socially constructed conflict spurred on by material developments in space technology and the material need for security. In essence, there was a "rump materialism" extant in the space race suggesting that it was not ideas (or ideologies) all the way down; ideas on how to achieve security in a material reality sparked the conflict.[2] Even today, ideas both are caused by and

1. Alexander Wendt, *Social Theory of International Politics,* (Cambridge, England: Cambridge University Press, 1999), 130-138. Wendt's chapter, Ideas all the way down? both repudiates neoclassical realism's assertions that material resources are causal in determining the structure of the international order and admits that material reality has "casual powers" but the causal and constitutive interaction between materials and ideational entities.
2. Wendt, *Social Theory of International Politics,* 109-113, 132.

constitute the reality in which nations operate. Thus, by discussing the ideas that constitute the space environment today, this study can then expound upon the material realities, whether found in a hostile technological threat or the physical starkness of outer space.

Starting with a brief review of the United Nations Outer Space Treaty of 1967 and the United Nations Moon Treaty of 1984, the first section of this chapter will provide an understanding of the existing international normative practices regarding the militarization of space. From there, the chapter will then summarize the corpus of American space policy and its evolution into the Obama Administrations' 2010 National Space Policy.

If strategy is truly a bridge between policy and action as military theorist Emile Simpson asserts, then the natural next step in this exposition is to explore current strategy as it relates to America's endeavors in space.[3] With a well-established abutment that is policy, the first spans of strategy, the bridge, may follow. Specifically, the author will examine 2011's National Security Space Strategy to synthesize a connection between American space policy aims and actions in outer space.

Chapter 1 illuminated the prevailing view that the United States lacks a comprehensive, well-defined, and executable space strategy. One can only perceive a void when aware of what surrounds the void. By looking at current American military and commercial exploits in space, as well as the actions of potential adversaries, this author intends to elucidate precisely the operational conditions within which United States space strategy is designed to operate. Additionally, the author will touch on the threat outer space, itself, poses. The examination of the strategic environment, in turn, will aid the reader in recognizing potential gaps in strategy. Furthermore, the reader will be

3. Emile Simpson, *War From the Ground Up: Twenty-First Century Combat as Politics,* (Oxford, England: Oxford University Press, 2015), 233. In Emile Simpson's insightful monograph about his experiences in Afghanistan, he builds upon the military theory of Carl von Clausewitz to develop an updated definition of war. His rationale, in part, is to help contemporary strategists understand how the old tropes of warfare no longer hold as valid and to implore current thinkers to build the bridge of strategy so that policy can truly achieve its aims. Otherwise, strategy, sans an abutment in policy, could be a bridge to nowhere. The reader should note that Colin Gray's book, *Strategy Bridge: Theory for Practice*, echoes the idea of linking policy and action. Furthermore, his 2015 book, *The Future of Strategy* illustrates a similar idea (p. 25).

equipped with an analytical framework comprised of a synthesis of policy, strategy, and environmental influences associated with space. This analytical framework will aid in testing the author's null hypothesis when viewed through theoretical lenses in chapter 3.

Space Treaties

By the time the United Nations drafted the *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies,* the Soviet-American duel in space had burned with intensity for a decade. The Soviet's successful launch of Sputnik on 4 October 1957 resonated as a "shot heard and seen around the world."[4] This shot, much like the starting gun for an Olympic race, kicked off a new era of technological progress undergirded by the ideological battle between the West and communism.

If the Soviet Union had a good start out of the blocks, the converse held for the United States. America's "highly touted and highly visible technology had been humbled and bested by the Soviet successes," which not only tarnished American prestige internationally but domestically as well.[5] Moreover, Sputnik demonstrated that the Soviets possessed the capability to develop ICBMs. As Nathan Goldman wrote, "For the first time since the English navy threatened its former colony in the War of 1812, the American homeland was vulnerable…[America's] isolation and security were forever gone."[6]

As if the humbling defeat embodied in Sputnik were not enough, Yuri Gagarin's historic spaceflight cast further doubts on American capability and compelled the nation to act.[7] Consequently, President Kennedy committed the nation to put humankind on the Moon before the end of the decade. He realized that the space race could aid American efforts in the Cold War by striking the Soviets at the source of their prestige, the space arena.[8]

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4. Nathan C. Goldman, *Space Policy: An Introduction,* (Ames, IA: Iowa State Press, 1992), 7.
5. Goldman, *Space Policy: An Introduction,* 7.
6. Goldman, *Space Policy: An Introduction,* 7.
7. Goldman, *Space Policy: An Introduction,* 86.
8. Goldman, *Space Policy: An Introduction,* 84-86.

Against this backdrop of the Soviet-American tit-for-tat security dilemma, the UN drafted the Outer Space Treaty. While some implications of the Outer Space Treaty will be discussed in further detail later in this chapter, the fundamental importance of the treaty lay in its specifying outer space (i.e. the Moon and other celestial bodies) as being the "province of all mankind" and that claims of sovereignty or national appropriation would not be recognized.[9] Furthermore, the Outer Space Treaty restricts the use of outer space to peaceful purposes only. Specifically, the Outer Space Treaty forbids the placement of weapons of mass destruction on orbit around the Earth and the installation of such weapons on celestial bodies.[10] Ultimately, the Outer Space Treaty encourages a spirit of cooperation, of scientific discovery, and of peace in delineating what actions signatories could perform in space.[11]

The Moon Agreement

The *Agreement Governing the Activities of States on the Moon and Other Celestial Bodies* of 1979 performs a similar function to the Outer Space Treaty.[12] The agreement, as the Outer Space Treaty does for outer space in general, declares the Moon the "province of all mankind," and restricts its use to peaceful endeavors only.[13] Like the Outer Space Treaty, the Moon Treaty prohibits placing weapons of mass destruction on orbit or on a trajectory around the Moon and forbids placing military installations on the Moon's surface.[14] Nations could establish manned or unmanned stations, open for use by any other party, so long as the stations were for the "freedom of scientific investigation."[15]

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9. United Nations Office for Outer Space Affairs, *United Nations Treaties and Principles on Outer Space, Related General Assembly Resolutions and Other Documents,* 2015), 3-4.
10. United Nations Office for Outer Space Affairs, *Principles on Outer Space,* 4.
11. United Nations Office for Outer Space Affairs, *Principles on Outer Space,* 3, 5-6.
12. The reader should note that the United States has not ratified or even signed the Moon Treaty and is considered a "non-party" to the Treaty. Nevertheless, while the treaty is not legally-binding, it has established a norm that the United States must account for in its decision-making processes concerning space activity. See "Agreement Governing the Activities of States on the Moon and Other Celestial Bodies," UN.org, Accessed 22 April 2016, http://disarmament.un.org/treaties/t/moon.
13. United Nations Office for Outer Space Affairs, *Principles on Outer Space,* 24.
14. United Nations Office for Outer Space Affairs, *Principles on Outer Space,* 24.
15. United Nations Office for Outer Space Affairs, *Principles on Outer Space,* 25-26.

Taken together, the Outer Space Treaty and Moon Treaty attempt to establish a global commons in outer space meant for expanding human discovery and scientific endeavor. Nancy Gallagher, interim director of the University of Maryland's Center for International and Security Studies, notes that "neither the Outer Space Treaty, nor any subsequent space law, though, provides detailed rules or an authoritative process for deciding what types of space activities are inconsistent with these principles."[16] Furthermore, the Outer Space Treaty does distinguish "when the individual or cumulative usage of space might damage the common interests, and how the benefits from space activities should be shared."[17] In other words, the desire keeping space a global commons is not enough; clearly defined categories of action and enforceable rules must accompany the intent.[18]

The ambiguities in treaties and international law, as highlighted by Gallagher, could bear particular importance on the way the United States has shaped national space policy and strategy. A potential future USAF astronaut corps may conflict with some of the nebulous categorizations of the UN's treaties and agreements.

A Brief Summary of Past American Space Policy

"A National Space Policy is something that every US Administration since Eisenhower has formulated."[19] While some perceived Eisenhower as anti-space, Eisenhower's policies towards space, including the development of military and commercial applications, demonstrated his pragmatism.[20] In the words of Nathan Goldman, "Eisenhower was a skeptic who had to be convinced, and who was convinced, about the importance of space for the future of the nation."[21]

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16. Nancy Gallagher, "Space Governance and International Cooperation," *Astropolitics* 8, (December 2010): 259.
17. Gallagher, "Space Governance and International Cooperation," 259.
18. The United Nations could follow the model found in their *Convention on the Law of the Sea.* See "Oceans and Law of the Sea," UN.org, Accessed 22 April 2016, http://www.un.org/Depts/los/index.htm. The US is a signatory to the treaty, but the Congress has not ratified the treaty.
19. Eligar Sadeh, "Towards a National Space Strategy," *Astropolitics* 8, (December 2010): 76.
20. For further study on Eisenhower's support for space programs, please see Dino Brugioni's, *Eyes in the Sky: Eisenhower, the CIA and Cold War Aerial Espionage*.
21. Goldman, *Space Policy: An Introduction,* 86.

Eisenhower's successor, John F. Kennedy campaigned on space issues and the so-called "missile gap" yet did not fully grasp the importance of space until it became a political necessity in reaction to Sputnik.[22] Clearly, Kennedy's challenge to the American public "to do things because they are hard" and put a man on the Moon demonstrated his renewed support for space programs that continued until his assassination. Following Kennedy, President Lyndon Johnson became the first chief executive "to express the value of space for national security and intelligence."[23]

Following what could be called the apex of American space exploration, successive presidents, Richard Nixon, Gerald Ford, and Jimmy Carter, never prioritized funding for NASA and other programs. In only a decade, American space programs stagnated and ultimately reached their proverbial nadir.[24]

The Reagan presidency, however, ushered in a resurgent American space program. Whether announcing active space efforts "in both the military and civilian sectors" or boosting NASA's budget by 30 percent, Reagan's efforts to broaden America's reach in space were far reaching.[25] Despite these efforts, the tragic accidents of NASA's *Challenger* and *Columbia* orbiters, along with receding exogenous threats following the 1990s peace dividend, relegated space to a distant orbit in the American budget and psyche. It should be no surprise, then, that the inkwell remained dry in the Oval Office to pen new space policy. In the years from 1996 until 2006, domestic policy and the war against violent extremism commanded greater attention.

Despite differences in the aims and thoughts on implementation of the United States National Space Policy, three major themes were evident in every administration's policy. Each policy sought "to secure the space domain for peaceful use; to protect space assets from all hazards; and to derive maximum value from space for security, economic, civil, and environmental ends."[26] To what extent each policy accomplished these aims remains outside the scope of

22. Dino A. Brugioni, *Eyes in the Sky: Eisenhower, the CIA and Cold War Aerial Espionage,* (Annapolis, MD: Naval Institute Press, 2010), 374; Goldman, *Space Policy: An Introduction,* 86.
23. Goldman, *Space Policy: An Introduction,* 87.
24. Goldman, *Space Policy: An Introduction,* 87-89.
25. Goldman, *Space Policy: An Introduction,* 89.
26. Gallagher, "Space Governance and International Cooperation," 257.

this work. It is fair only to assert that each space policy was a product of the broader political environment of the time. Policy does not have an agency of its own. Accordingly, this brief synopsis of American space policy sets the stage for the ensuing discussion on current National Space Policy and the follow-on investigation of space strategy. In looking at the 2010 National Space Policy, it is important to note that it, too, is both a product of the international environment and the evolution of American policy. Additionally, the operational environment also influences policy. Furthermore, it is not just current bodies that exert gravity to pull and shape space policy, but the future factors for which policy and strategy must account.

2010 National Space Policy

In June 2010, President Obama released the new *National Space Policy of the United States of America*. Demonstrating the idea that policy rarely sheds earlier policy influence, this policy reaffirms the established norms of the use of space for "peaceful purposes" and defends the "global commons" nature of space. The National Space Policy also rejects claims of sovereignty in space just as first proclaimed in the Outer Space Treaty and Moon Treaty[27] Moreover, the 2010 policy, much like earlier United States space policies, confirms that the United States possesses a right to defend its interests in outer space.[28] Furthermore, the United States will deter and dissuade potential aggressors from attempting to hinder American activity on orbit.[29] Interestingly, despite the political campaigning and messaging that indicate a new administration will depart from its predecessors' ways, the 2010 policy retains much of the Bush administration's policy goals as specified in the 2006 space policy rendition. The biggest difference may, in fact, reside in stylistic and structural variations.

As John Mariel of the Space Foundation points out, "The principles in both policies are very similar in substance, but the tone is different in almost every case."[30] According to Mariel, where the 2006 policy principles connoted a

27. White House, *National Space Policy of the United States of America,* (Washington, DC: US Government Printing Office, 28 June 2010), 3.
28. White House, *National Space Policy of the United States of America,* 3.
29. White House, *National Space Policy of the United States of America,* 3.
30. Mariel John, *U.S. National Space Policy Comparison: Comparing the 2010 National Space Policy to the 2006 National Space Policy,* (Colorado Springs, CO: Space

specificity to the United States, the 2010 version eschews particularity; instead, it promotes the universality of principles. This difference in style and tone is reflected in the structure of the 2010 policy. While the 2006 policy followed the introductory material with general guidelines and national security guidelines, the 2010 policy emphasizes international collective action and cooperation over unilateral programs required to preserve space as demonstrated by the relegation of national security guidelines to the end of the policy document.[31]

The differences in emphasis (i.e., between universal and American-focused principles and goals) bear a particular importance in answering the main question of this study. If "the United States considers the sustainability, stability, and free access to, and use of, space vital to its national interests," yet also espouses a belief that "space operations should be conducted in ways that emphasize openness and transparency" how would the nation construct a USAF astronaut corps while adhering to these principles?[32] Moreover, building a USAF astronaut corps would seemingly comport with the goal of "energiz[ing] competitive domestic industries."[33] The infrastructure required to build such a team certainly extends beyond manpower, as the launch, spaceflight, and recovery of members of this corps will require efforts from private industry.[34] Conversely, as the other governmental space activities energize the private sector, the need for a USAF astronaut corps may increase.

The 2010 policy's goals also influence the analysis of the author's hypothesis. Specifically, President Obama set goals of strengthening stability in space, increasing assurance and resilience of mission-essential functions, and the pursuit of human and robotic initiatives.[35] At first glance, the advent of a corps of military astronauts would seemingly aid in building stability and assure critical national capabilities in space, but further analysis in chapter 3 may suggest otherwise. The pursuit of human and robotic initiatives will affect directly the perceived necessity of a USAF astronaut corps. If the momentum

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Foundation, 2011), 1.
31. White House, *National Space Policy of the United States of America,* 5-9, 13-14; White House, *U.S. National Space Policy,* (Washington, DC: US Government Printing Office, 2006), 3-5.
32. White House, *National Space Policy of the United States of America,* 3.
33. White House, *National Space Policy of the United States of America,* 4.
34. White House, *National Space Policy of the United States of America,* 4.
35. White House, *National Space Policy of the United States of America,* 4.

for human endeavor decreases with a commensurate increase in robot performed civil, commercial, and military space missions, military astronauts may not be required.

Finally, it is important to recognize that while policy has largely remained constant in kind, it has differed in implementation and prioritization. The goals of maintaining American leadership in space and the preservation of space for humankind will endure. Other goals, however, such as increasing confidence-building measures with our allies and planning for manned exploration of asteroids and Mars may change with executive and congressional transition.[36] Consequently, developing a strategy for space will shift with changes in policy. As stated earlier in this study, though, part of the purpose of examining these issues is to anticipate the changes to prevent the nation from suffering strategic surprise.[37]

From Space Policy to Space Strategy

The current National Security Space Strategy sets out to prevent strategic surprise for the United States. Published in 2011, the National Security Space Strategy stems from the 2010 National Space Policy and 2010 National Security Strategy. The National Security Space Strategy identifies three trends regarding the strategic environment in which the American strategy must operate. According to the document, space has become "increasingly congested, contested, and competitive."[38] In order to cope with these trends, the National Security Space Strategy lays out the following strategic objectives: to "strengthen safety, stability, and security in space;" to "maintain and enhance the strategic national security advantages afforded to the United States by space;" and to "energize the space industrial base that supports US national

36. White House, *National Space Policy of the United States of America,* 7, 11.
37. The Department of Defense released its version of a space policy in 2012 to explain how the department would fulfill the National Space Policy. The policy, DOD Directive 3100.10 echoes much of the National Space Policy but adds more language on space's importance to national security. Furthermore, the directive states that the nation will attempt to "extend the battlefield advantages that space systems can provide to allies and coalition partners, to the maximum practicable extent." There is a possibility that a USAF astronaut force would aid in achieving that goal.
38. Department of Defense and The Intelligence Community, *National Security Space Strategy (Unclassified Summary),* (Washington, DC: US Government Printing Office, January 2011), 1.

security."[39] These objectives, in turn, give way to five "strategic approaches." Of the five, three have direct ties to the military instrument: to improve United States space capabilities, prevent and deter aggression against space infrastructure that supports national security, and prepare to defeat attacks and to operate in a degraded environment.[40]

Ultimately, the National Security Space Strategy proclaims that achieving strategic objectives will require a whole-of-government approach to preserve American advantages in space while addressing the reality that space is now more congested, contested, and competitive than ever before.

While the strategic environment will be discussed in detail in the next section of this chapter, the last two adjectives bear particular emphasis. First, space is increasingly competitive. In order to counter increasing global competition and a perceived erosion of its technological lead, the National Security Space Strategy recommends that the United States bolster the space industrial base.[41] As the National Security Space Strategy acknowledges, "US suppliers, especially those in the second and third tiers, are at risk due to inconsistent acquisition and production rates, long development cycles, consolidation of suppliers under first-tier prime contractors, and a more competitive foreign market" while "a decrease in specialized suppliers further challenges US abilities to maintain assured access to critical technologies, avoid critical dependencies, inspire innovation, and maintain leadership advantages."[42] Furthermore, the atrophying industrial base is accompanied by "challenges in recruiting, developing, and retaining a technical workforce."[43] In

39. Department of Defense and The Intelligence Community, *National Security Space Strategy,* 4.
40. Department of Defense and The Intelligence Community, *National Security Space Strategy,* 5. The other two approaches include promoting "the responsible, peaceful, and safe use of space," and partnering "with responsible, nations, international organizations, and commercial firms."
41. Department of Defense and The Intelligence Community, *National Security Space Strategy,* 3.
42. Department of Defense and The Intelligence Community, *National Security Space Strategy,* 3.
43. Department of Defense and The Intelligence Community, *National Security Space Strategy,* 3. It is worth mentioning that the National Security Space Strategy uses data from the satellite manufacturing industry to support the claim that American technical knowledge is at risk. While the data is specific to one sector of the space industry, the American lead is also slipping in another major area, namely spacelift.

essence, unless the federal government makes a concerted effort to boost indigenous technological capability, national security will suffer. Will boosting the industrial base lead to a need for USAF astronauts or would engineering such a force be one way to inject growth into the private sector?

Second, "space is increasingly contested in all orbits."[44] Potential adversaries have sought and will continue to "deny, degrade, deceive, disrupt, or destroy [national] assets."[45] Furthermore, "as more nations and non-state actors develop counter-space capabilities over the next decade, threats to US space systems and challenges to the stability and security of the space environment will increase."[46] Will these potential threats justify building a USAF astronaut force, and would such a force mitigate the effects of these threats? Additionally, will the National Security Space Strategy's "multilayered deterrence" approach actually dissuade potential adversaries from aggressive behavior?[47] Furthermore, if deterrence fails, will the nation's response "impose international costs" of sufficient magnitude to compel an adversary to change course?[48] Will a USAF astronaut corps be a required part of the multilayered approach? What roles or missions would the Airmen astronaut perform as part of the nation's greater space strategy? The following discussion on the strategic environment may provide insight in formulating answers to these questions.

Strategic Environment

At the macro-level, the strategic space environment is more congested, contested, and competitive as the *National Security Space Strategy* asserts. This section will now explore some of the micro-level details that make such an assertion reasonable. The author has outlined a picture of space and will now

44. Department of Defense and The Intelligence Community, *National Security Space Strategy,* 3.
45. Department of Defense and The Intelligence Community, *National Security Space Strategy,* 3.
46. Department of Defense and The Intelligence Community, *National Security Space Strategy,* 3.
47. Department of Defense and The Intelligence Community, *National Security Space Strategy,* 13.
48. Department of Defense and The Intelligence Community, *National Security Space Strategy,* 13.

apply pointillism to fill in the details while accentuating the strategic environment's chroma.

First, this study assumes that the United States is a spacefaring nation.[49] The strategic goals and objectives of American political leadership incorporate the fact that it is a spacefaring nation. If it were not so, then arguably the country could subsist without its space capabilities. In other words, it is not just that the United States desires to maintain its presence in space but that it must do so for national security. American spacepower has raised the bar, and current space capabilities now form the baseline of assumed national power. Therefore, leaving space is not an option. Hence, the strategist must understand the contextual environment of space.

To that end, this section will now examine American commercial and military space activities that already function within the strategic context and will likely continue doing so. While there are many activities to consider that influence the answer to the author's hypothesis, two main commercial efforts, those of space exploration and space mining, will be the focus of discussion. Both commercial exploration and resource development will hint at the need for a guardian. Whether that entity is the USAF or not, the author will highlight some areas where rescue, protection, or both may be necessary for any future economic development of space.

The role of space rescue, however, has a foot in both the commercial and military realms. Thus, the discussion will also cover rescue from the traditional combat rescue role. Additionally, this paper will examine the USAF's role as keeper of the government's satellite constellation and how orbital repair missions might necessitate military astronauts. Finally, while the Outer Space Treaty prohibits placing weapons of mass destruction on orbit, it does not preclude conventional capabilities. The reader, therefore, will learn how developing USAF astronauts might lead to the weaponizing of space.[50]

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49. John F. Kennedy, President of the United States, (Address, Rice University, Houston, TX, 12 September 1962). From as early as the 1960s, the United States has labeled itself as a spacefaring nation. President John F. Kennedy's remarks at Rice University implored the nation to be "world's leading spacefaring nation."
50. Chapter 3 will fully explore the implications associated with weaponizing space both from Realist and Liberal institutionalist perspectives.

Civilian Space Exploration

The commercialization of space does not seem to warrant the great investments in human resources and infrastructure necessary to build a USAF astronaut corps. USAF Major Randy Gordon suggests "the emerging hybrid partnership between government and commercial entities…represents a viable way for the achievement of space strategy ends using realistic means."[51] This hybrid relationship may help the nation meet strategic goals, but the commercialization of space does not, in and of itself, merit military astronauts. What commercial efforts would change this answer?

Commercial space exploration may be a forcing function for the military to cultivate a USAF astronaut corps. Only one American company, however, has put private citizens into Earth's orbit. Space Adventures launched its first client, Dennis Tito, in April 2001.[52] Since then, Space Adventures has rocketed another six clients into orbit with each spending approximately 10 days onboard the International Space Station.[53] NASA intends to use and support the International Space Station until 2024 when, in theory, the organization will be ready for missions to asteroids and Mars.[54] Consequently, commercial space exploration, through the use of the International Space Station, will last another eight years. Would space tourists ever need rescue? Moreover, would a USAF astronaut cadre be able to fulfill such a role? The answer appears to be negative.

First, with an accompanying 20 million dollar price tag per tourist, and only one trip in the last seven years, Space Adventures' missions do not happen often enough to justify the cost of a USAF astronaut rescue force even if said

51. Randy Gordon, "The Landmark Space Age Thucydides: Human Spaceflight in the State's Grand Strategic Quest to Address Fears, Advance Interests, and Garner Honor" (M.A. thesis, Air University, June 2011), 116.
52. "International Space Station Clients," Space Adventures.com, 2016, Accessed 10 February 2016, http://www.spaceadventures.com/experiences/space-station/.
53. "International Space Station Clients."
54. Brad Plumer, "NASA Wants to Keep the International Space Station Going Until 2024. Is That a Good Idea?," *Washington Post,* 9 January 2014, https://www.washingtonpost.com/news/wonk/wp/2014/01/09/nasa-plans-to-keep-the-international-space-station-going-until-2024-is-that-a-good-idea/.

force could stand up in time to influence a rescue operation. Second, the few trips that have occurred have been in close coordination with NASA.[55] Thus, Space Adventures' activities should fall solely within the purview and expertise of NASA. Moreover, International Space Station crews plan to use the docked *Soyuz TMA* capsule as an escape vehicle in times of emergency.[56] Whether from a station malfunction or the activities of an aggressor, USAF astronauts, serving as a protector or as a rescue force, would provide a redundant capability for this particular aspect of civilian space exploration.

If military astronauts would prove redundant for assisting (or protecting) commercial trips to the International Space Station, astronauts would prove useless for sub-orbital adventures. While multiple companies like Virgin Galactic, XCOR Aerospace, zero2infinity, and Space Adventures all have plans to sell sub-orbital trips to a long list of willing customers, each of these flights last mere minutes, thus obviating any need for rescue.[57] In fact, rescue would be impossible.[58] Yet, as a following section will show, commercial space activities may eventually require rescue operations.

Space Mining

Modern commercial space efforts consider more than just exploration's possibilities. Space's myriad precious resources draw commercial focus and beckon humankind to space. Just in the Moon's regolith, or top layer of soil, exist large amounts of the "volatile elements of hydrogen, carbon, and helium."[59] Moreover, alpha particles from the solar wind collect on the Moon's

55. "International Space Station Clients."
56. Steven Swanson (Distinguished Educator in Residence and Professor of the Practice Division of Research and Economic Development, Boise State University and Former NASA Astronaut), Interview by author, 13 January 2016.
57. "Zero2infinity and Spacecialist Partner to Promote Access to Near-Space," 22 May 2013, Accessed 10 February 2016, http://www.0ll00.com/2013/05/zero2infinity-and-spacecialist/. ; "Suborbital Spaceflight," Space Adventures.com, 2016, Accessed 10 February 2016, http://www.spaceadventures.com/experiences/suborbital-spaceflight/. ; "The XCOR Flight to Space," XCOR.com, 2016, Accessed 10 February, http://spaceexpeditions.xcor.com/the-spaceflight/. ; "Your Flight to Space," Virgin Galactic.com, 2016, Accessed 10 February 2016, http://www.virgingalactic.com/human-spaceflight/your-flight-to-space/.
58. Swanson, Interview by author.
59. John S. Lewis, *Mining the Sky: Untold Riches from the Asteroids, Comets, and Planets,* (Reading, MA: Helix Books, 1996), 47-48.

surface making Helium-3, a potential fuel source for nuclear fusion, available for extraction.[60] These resources act as a potential carrot to attract industry to space mining endeavors.[61]

In a similar way, asteroids show promise for future mineral extraction. Most asteroids contain minerals commonly found on Earth, such as iron, but the near-Earth asteroids possess nearly 50 times more ore than the entire Earth's deposits.[62] Extracting this ore could help to ease the strain on the globe's resources. Additionally, companies could obtain the same gases found on the Moon from near-Earth asteroids. Doing so would aid space exploration significantly when used for on-orbit refueling stations. The United States is aware of the financial treasures located in space. Late in 2015, President Obama signed into law the *US Commercial Space Launch Competitiveness Act,* which decreed that private citizens involved in commercial exploration in space could, in fact, "possess, own, transport, use, and sell the asteroid resource or space resource."[63] Companies like Planetary Resources stand to benefit greatly from this law as it has already sent robotic probes to investigate near-Earth asteroids. But the advent of outer space prospecting raises the question that USAF Major George Ebert addressed in his Air Command and Staff College thesis. If the outer space "gold rush" proves real, who will adjudicate territorial claim disputes? Moreover, who will offer protective services when the prospectors cannot protect themselves? Moreover, who will combat what Jai

60. Claude A. Piantadosi, *Mankind Beyond Earth: The History, Science, and Future of Human Space Exploration,* (New York, NY: Columbia University Press, 2012), 102; "Helium-3 Mining on the Lunar Surface / Energy," European Space Agency, 2016, Accessed 22 February 2016, http://www.esa.int/Our_Activities/Preparing_for_the_Future/Space_for_Earth/Energy/Helium-3_mining_on_the_lunar_surface.
61. Piantadosi, *Mankind Beyond Earth,* 103.
62. "Asteroids Will Unlock the Solar System's Economy," Planetary Resources.com, 2016, Accessed 22 February 2016, http://www.planetaryresources.com/asteroids/#asteroids-intro. ; Lewis, *Mining the Sky: Untold Riches from the Asteroids, Comets, and Planets,* 191-194.
63. *U.S. Commercial Space Launch Competitiveness Act*. H.R. 2262, 114th Cong., 1st sess., (2015), 18. The international community has already contested this act. See Peter B. de Selding, "U.S. Commercial Space Act's Treaty Compliance May Depend on Implementation," *SpaceNews,* 9 December 2015, Accessed 22 April 2016, http://spacenews.com/u-s-commercial-space-acts-treaty-compliance-may-depend-on-implementation/.

Galliott believes to be inevitable, space piracy?[64] Ebert makes a strong argument that the United States government must protect its citizens using the guidance of the Outer Space Treaty as his basis as well as economic and security interests.[65]

Assuming the US will make efforts to protect its citizens is reasonable. The next question, then, is how should the nation proceed in doing so? While Ebert thinks the military will be required, chapter 3 will examine how such an endeavor will have impacts far beyond just protecting citizens in space. Nevertheless, the developments in space mining have highlighted the need to think about developing a USAF astronaut corps.

Space Rescue

The discussion of the two primary commercial space activities highlighted how future participants in these activities may require rescue or protective services.[66] USAF astronauts may fill this need for a space guardian. Private citizens, however, may not be the only personnel requiring a guardian. Military members may also require rescue. As USAF Lieutenant Colonel Mari Manifold posited, the United States is ill-prepared to perform the space rescue mission.[67] She asserts that a civil-military venture, similar to the Civil Reserve Air Fleet, could meet the need for space rescue using a combination of civilian astronaut pilots and military rescue forces.[68] Is a rescue force required? Using assumptions that the military will naturally want to put humans into space, Manifold then argues that their presence would present a potential asset for hostile nations to target that could require rescue.[69] While such a supposition begs the question of why the military must, by default, put personnel in space,

64. Jai Galliott, *Commercial Space Exploration: Ethics, Policy and Governance (Emerging Technologies, Ethics and International Affairs),* New ed. (Burlington, VT: Ashgate Publishing Company, 2015), 305-307.
65. George M. Ebert, "Protecting Space-Age Prospectors: The Necessity for a Military Presence in the Final Frontier" (M.A. thesis, Air Command and Staff College, 2013), 11-22.
66. At the very least, the discussion has highlighted the necessity of thinking about future problems related to the expansion of space commercialization.
67. Mari Manifold, "Personnel Recovery in Space.," *Air & Space Power Journal* 29, (November/December 2015): 56.
68. Manifold, "Personnel Recovery in Space.," 57.
69. Manifold, "Personnel Recovery in Space.," 56-57.

the article puts forth an idea on space personnel rescue that merits consideration. If rescue is a moral imperative as former Chief of Staff, General T. Michael Moseley, asserts, then it follows logically that the military will need to develop a space rescue capability if the nation stations military personnel in space.[70]

Earlier in this chapter, the author discussed how International Space Station astronauts have built-in rescue capabilities. They plan to use the *Soyuz* capsule docked to the Station.[71] Moreover, American and Russian systems employ launch escape towers in order to protect astronauts during launch emergencies.[72] Thus, rescue by an outside agency seems unnecessary.

What about commercial space missions? As mentioned earlier, suborbital missions are too short for a rescue to be possible. The one category of commercial space exploration that could warrant building a space rescue force is deep-space exploration. As the 2010 National Space Policy explained, the United States intends to explore Mars by the year 2030. Currently, there is extensive debate about the feasibility of such a goal. Some scholars doubt that the nation is serious about going to Mars given the preoccupation with the exploration of asteroids.[73] These scholars assert that the next logical step in space exploration is a return to the Moon. Going to the Moon is considered necessary to learn more about long-duration missions outside the protective bubble of Earth's Van Allen belts. Such an idea, while popular in the 2006 National Space Policy, was removed from the table much to the chagrin of experts in the space science community.[74]

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70. T. Michael Moseley, "Memorandum for Combatant Commanders," 26 February 2006.
71. Adrien Adams, *Operational and Medical Procedures for a declared Contingency Shuttle Crew Support Shuttle mission due to a failure that precludes a safe return,* (Houston, TX: Kyle Integrated Science and Engineering, 15 September 2010), ; David J. Shayler, *Space Rescue: Ensuring the Safety of Manned Spaceflight,* (Chichester, UK: Praxis Publishing, 2009), 277-285; Robert Frost, "What is the Emergency Rescue Protocol in the ISS?," 22 July 2013, Accessed 10 February 2016, https://www.quora.com/What-is-the-emergency-rescue-protocol-in-the-ISS.
72. Shayler, *Space Rescue: Ensuring the Safety of Manned Spaceflight,* 85-87, 102-104, 153-177.
73. Piantadosi, *Mankind Beyond Earth,* 40; White House, *National Space Policy of the United States of America,* 7, 11.
74. Calla Cofield, "The Moon or Mars? NASA Must Pick One Goal for Astronauts, Experts Tell Congress," Space.com, 4 February 2016, Accessed 22 February 2016, http://www.space.com/31835-nasa-needs-single-mission-goal-congress.html? ;

Despite the debate on the focus of America's civil space efforts, private companies continue planning for deep-space exploration, including journeys to Mars. SpaceX and Virgin Galactic have proposed sending humans to Mars by the middle of the next decade.[75] Similarly, the Dutch company, Mars One, has put forth plans to send private citizens into deep-space with no intention of bringing them back.[76] While NASA builds its missions as self-contained endeavors, with rescue capabilities manufactured into the space vehicles themselves or integrated into safety plans, the proposed commercial deep-space efforts make no such plans.[77] Thus, if something goes wrong, will the United States or other nations feel compelled to lend assistance or rescue private citizens? Alternatively, do these citizens, by signing up for such adventures, give up expectations of protection from the government?

Dr. Jai Galliott, an expert on space law, suggests not. To him, private space explorers could be treated like seafarers who are protected under the UN's International Law of the Sea.[78] Parties to that law are expected to render assistance, within reason, to those persons experiencing distress upon the open sea.[79] The same could be true in space.[80] If the United States were to adopt a

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Piantadosi, *Mankind Beyond Earth,* 336. Dr. Piantadosi lays out a compelling case for why it is foolhardy for the United States to race to Mars when there are some critical interim steps the nation must make that can only come about via a cislunar or lunar expedition. Interestingly, his advice is not unique, yet the White House in removing the Moon from the possible mission schedule for NASA, has in a way, stated that the nation will not actually go to Mars either.

75. Miriam Kramer and Jessica Plautz, "Sir Richard Branson Wants to Colonize Mars, But He's Willing to Share," Mashable.com, 6 November 2015, Accessed 22 February 2016, http://mashable.com/2015/11/06/richard-branson-mars-virgin-galactic/#wT0S8qQLCOqh. ; Keith Wagstaff, "Elon Musk Says SpaceX Will Send People to Mars By 2025," *NBC News,* 29 January 2016, Accessed 22 February 2016, http://www.nbcnews.com/tech/tech-news/elon-musk-says-spacex-will-send-people-mars-2025-n506891.

76. "About Mars One," Mars-One.com, 2016, Accessed 22 February 2016, http://www.mars-one.com/about-mars-one.

77. Swanson, Interview by author.

78. Galliott, *Commercial Space Exploration,* 305-307.

79. Galliott, *Commercial Space Exploration,* 305-307.

80. The United Nations declares that astronauts are the "envoys of mankind," and are entitled to assistance during times of duress. The United Nation's declarations, however, seem to cover cases when a spacecraft returns to Earth and lands upon the high seas or in a foreign territory. The agreements do not specifically address space rescue. Nevertheless, there is a precedent of rendering assistance to another nation's astronauts. See United Nations Office for Outer Space Affairs, *Principles on Outer Space,* 4, 8-10.

similar policy for space, how far would its responsibility to protect extend? Moreover, would the responsibility to protect extend only to cases of space rescue or does protection require greater presence as in a space police force? The United States could choose to use NASA astronauts or a separate USAF-founded corps to fulfill such a responsibility.

Borrowing from Department of Defense Instruction 1300.23, the Defense Department states:

> Preserving the lives and well-being of US military, DoD civilians, and DoD contractor personnel authorized to accompany the US Armed Forces who are in danger of becoming, or already are, beleaguered, besieged, captured, detained, interned, or otherwise missing or evading capture (hereafter referred to as "isolated") while participating in U.S.-sponsored activities or missions, is one of the highest priorities of the Department of Defense. DoD contractor personnel authorized to accompany US forces are identified in DoDI 3020.41 (Reference (d)). The military, DoD civilians, and DoD contractor personnel authorized to accompany the US Armed Forces are hereafter referred to as "DoD personnel."[81]

Would rescuing United States citizens be an equally high priority for the government? The author already discussed how the USAF astronaut could fill the role of protector for space tourists and prospectors. The same assumption, that the United States will not shun its responsibility to protect its citizens even in space would suggest that space rescue could be a mission the government would perform. The USAF already maintains that it will assist in "collateral missions," which include "humanitarian relief, international aid, non-combatant evacuation operations, support for NASA flight operations, and mass rescue operations."[82] Manifold astutely asks, will the Outer Space Treaty's stipulations that nations must render all possible assistance to another nation's astronauts and that astronauts should provide support to other parties whenever possible apply to private citizens?[83] Are commercial spacefarers still astronauts? If so, then the United States has an obligation to render them assistance even to the point of rescue. This fact may be the biggest reason for

81. Department of Defense (DOD) Instruction 3002.01, *Personnel Recovery,* 4 April 2013.2.
82. Air Force Doctrine Annex 3-50, *Personnel Recovery,* 4 December 2014.4.
83. Manifold, "Personnel Recovery in Space.," 58.

the USAF to build an astronaut corps given its extensive experience in personnel recovery heretofore.

This thesis does not purport to know how the USAF would render such assistance in space. Instead, the desire is to highlight a potential capabilities gap. The gap does not exist yet, but it could. USAF astronauts may fill that gap. Airmen astronauts may well fulfill the role of space police, charged with the mission to rescue and protect.

Orbital Repair

Commercial space efforts are not the only factors inducing a review of the USAF's posture for future manned space missions. There is a panoply of space missions reliant on the ubiquitous satellite. As of the end of 2015, the US Strategic Command's Joint Space Operations Center (JSpOC) tracks over 16,000 space objects, of which nearly 1,400 are working satellites.[84] Among the multitude of satellites are the United States' military and intelligence satellites, which perform a varying array of missions ranging from weather observation, communications and navigational aids, missile warning, space situational awareness, and reconnaissance.[85]

How does the nation keep these "birds" functioning? Designers build satellites with large margins of safety and reliability to maximize operational lifespans. There is no easy way to repair a satellite once on orbit; it is usually more costly to attempt repair than it is to launch a replacement into orbit. Nevertheless, there is a precedent for on-orbit repair. NASA designed the Space Transportation System, more commonly called the Space Shuttle, with a requirement for the ability to repair satellites on orbit.[86] In fact, NASA often fixed systems on orbit with the last being the Hubble Space Telescope in

84. "USSTRATCOM Space Control and Space Surveillance - U.S. Strategic Command," US Strategic Command, January 2014, Accessed 22 February 2016, https://www.stratcom.mil/factsheets/11/Space_Control_and_Space_Surveillance/. ; "UCS Satellite Database," *Union of Concerned Scientists,* 25 February 2016, Accessed 22 April 2016, http://www.ucsusa.org/nuclear-weapons/space-weapons/satellite-database#.VxqMSNwja7F.
85. *AU-18 Space Primer,* (Maxwell AFB, AL: Air University Press, 2009),
86. David M Harland, *The Story of the Space Shuttle (Springer Praxis Books),* 2004 ed. (New York, NY: Springer Praxis, 2004), 5-7.

2009.[87] Additionally, NASA and the USAF built a joint human spaceflight engineering program whereby military payload specialists accompanied NASA astronaut crews into space with national security payloads.[88] While there were some sources of friction between the NASA crews and the USAF payload specialists, the joint venture completed eleven classified missions from 1982 until 1992.[89] One could argue, however, that the nation used astronauts to repair in-orbit systems because the government could, not because it was necessary.

Today, there is no on-orbit repair capability. This lack of capability, however, may not matter since space systems are increasingly reliable. Reliability comes with a price. To counter rising costs, the USAF has investigated using less expensive nanotechnologies that promise similar capabilities with the added benefit of being expendable and replaceable.[90] These smaller systems also help reduce the cost of space launch.[91] Still, even with smaller, cheaper, and more reliable systems, a satellite's lifespan eventually ends. These satellites perform one last fuel burn to place them in the so-called graveyard orbit. While space is expansive, the big-sky theory is not valid in space.[92] Hence, there is some rationale for trying to extend space system life. Beyond space hardware expense, littering orbits with abandoned systems can increase risk for future exploration and other missions. To that end, both NASA and DARPA are working on ways to repair space systems, even those "satellites not designed to be serviced," using robots.[93]

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87. Piantadosi, *Mankind Beyond Earth,* 110-111.
88. Jeff DeTroye*, et al.*, "National Security," in *Wings in Orbit* (Houston, TX: NASA, 2011), 46.
89. DeTroye*, et al.*, "National Security," 46-48.
90. Eva S. Jenkins, "Nanotechnology Enabling Future Space Viability," *Air Force Journal of Logistics* XXXV(1&2), no. 1&2 (22 March 2011): 10.
91. With current technologies, experts calculate that it costs between 3,600 dollars and 11,000 dollars per pound of payload to launch a system into space. See *AU-18 Space Primer,* 109.
92. Big-sky theory holds that in the air, two randomly flying bodies are extremely unlikely to collide given the size disparity between the expanse of the sky and the relative diminutiveness of the aircraft. See William R. Knecht, "Modeling the Big Sky Theory," *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* 45(2), no. 2 (October 2001): 87.
93. "Satellite Servicing Capabilities Office," NASA*,* 2016, Accessed 22 February 2016, http://ssco.gsfc.nasa.gov/robotic_refueling_mission.html. ; Martyn Williams, "DARPA Envisages Robotic Satellite Repair Missions," *PC World,* 11 September 2015,

It would seem, therefore, that the USAF may not need astronauts to perform a space support role; at least, not in the sense of space system repair. Will there be systems in the future, however, that would require an on-orbit military expert to conduct the repair? The nation and the USAF will have to assess the sensitivity and value of its systems before deeming robotic repair as undesirable. One reason for accepting the increased risk of sending humans to space might be a robotic system's potential vulnerability to cyber attacks. During periods of peace, the nation may not accept risking human life even if it meant space systems sustained cyber attacks. If, however, "physical conflict begets cyber conflict," then in war, the nation may view repairing and protecting vital national capabilities as worth risking a few astronauts' lives.[94]

Space Weapons

If on-orbit system repair does not require necessarily placing USAF personnel into space, perchance the advent of advanced space weapons will. Recall, the Outer Space Treaty prohibits countries from placing weapons of mass destruction on Earth's orbit. The Moon Treaty proscribes the same for the Moon. There is no explicit prohibition, however, against placing defensive weapons onto orbit. Although, putting such systems into space can indeed spark a security dilemma for the rest of the international community and fellow space actors. Consequently, the United States has refrained from putting overtly offensive or defensive systems on orbit.[95] Thus, there is no current need for USAF personnel to operate weapons in space.

The future may confer upon the United States a different opinion, especially if technological development will force countries to weaponize space

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http://www.pcworld.com/article/2983657/darpa-envisages-robotic-satellite-repair-missions.html.

94. Jason Healey and Karl Grindal, *A Fierce Domain: Conflict in Cyberspace, 1986 to 2012,* (Washington, DC: Cyber Conflict Studies Association, 2013), 21.

95. James C. Moltz, *The Politics of Space Security: Strategic Restraint and the Pursuit of National Interests,* 2nd ed. (Stanford, CA: Stanford Security Studies, 2011), 400; Warren Ferster, "Missile Defense Agency Retires Nfire Satellite," SpaceNews.com, 29 September 2015, http://spacenews.com/missile-defense-agency-retires-nfire-satellite/. Open source reporting shows that the Missile Defense Agency tried to employ a satellite-killing mechanism on its Near-Field Infrared Experiment, but Congress removed funding for that aspect of the program. Additionally, the US tested close fly-bys of other satellites as a potential anti-satellite tactic.

as some scholars assert.[96] Yet, the validity of technological determinism as a theory is debatable.[97] Indeed, espousing the idea that technological progress will lead to space's weaponization can push nations closer to such a reality. Such an idea engenders fear-induced reactions based on one's misperceptions of another actor's intent. Furthermore, such a consequence is more likely if governments do not proceed with caution as James Moltz suggests they should.[98] While this study will investigate the theoretical repercussions of a USAF astronaut corps in the next chapter, it is important to ask what could the future of space weaponization hold as technological development continues. To that end, futurist and geopolitical analyst, George Friedman posits that the future will require the deployment of on-orbit battle stations that will enable the United States to fight a multi-dimensional and anti-access war where the only real way to adequately command and control will be from space directly.[99] Moreover, these stations will "be the eyes, ears, and fists of the United States."[100] Friedman makes no claim that his predictions are valid. Rather, his thought exercise is exactly that, an exercise to brush away mental cobwebs and long-held schemata that could hinder American leadership in the future. If the nation were ever to pursue something like Friedman's Battle Stars, such a system would likely require USAF astronauts. Importantly, earlier predictions of military manned weapons systems have not come true. Navy Commander Daniel Hansen's USAF Air War College thesis argued manned military systems would be needed by 2025 to perform the "combat mission elements of space control and force application."[101]

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96. Moltz, *Politics of Space Security,* 31-37. Moltz is not one of these scholars, however, his explanation of technological determinism as it relates to space weaponization is superb.
97. See Donald Mackenzie's *Inventing Accuracy* for a well laid out argument against technological determinism. Using the case study of inertial navigation systems in ICBMs, Mackenzie demonstrates the social constructivism aspect of technological innovation.
98. Moltz, *Politics of Space Security,* 31-36, 316-318.
99. George Friedman, *The Next 100 Years: A Forecast for the 21st Century,* (New York, NY: Doubleday, 2010), 166-201.
100. Friedman, *The Next 100 Years: A Forecast for the 21st Century,* 184.
101. Daniel L. Hansen, "Exploration of the Utility of Military Man in Space in the Year 2025" (M.A. thesis, Air University, 1992), 18-19. Written in 1992, it should come as no surprise that Hansen could not have foreseen the rise of China's space program and the security dilemma in which the United States now finds itself. Nevertheless, while Hansen offers compelling reasons for putting military members in space, he bases his

Another potential weapon of interest is not a weapon, but a method of delivering weapons. The US Marine Corps' SUSTAIN project, headed by Roosevelt Lafontant, is a proposed suborbital hypersonic delivery capability. The system would deliver a platoon of Marine infantrymen anywhere around the world in less than two hours.[102] This concept, which seems the product of imagination and seemingly beyond the capability of current technology, is real. If such a capability came to fruition, piloting such a vehicle (if piloted at all) could require the expertise of USAF astronauts, well-versed in atmospheric and spaceflight. Naturally, the Marines would likely fight to keep the project within their control, but as has been demonstrated expertly by Air Mobility Command, the USAF has a well-established history of moving the other service's personnel.

What Other Nations Are Doing in Space

Current and potential American space activities constitute the centroid of analysis for this chapter. The only vacuum, however, in space is the physical one. Other nations also exert influential forces on American space policy, planning, and strategy. Hence, the National Security Space Strategy's assessment that space is increasingly competitive and contested. The United States, while still the leader in space capabilities, faces challenges from near-peers like China and Russia, as well as other emerging space actors.[103] A cursory understanding of these spacefaring nations' activities, and what threats they may pose helps to frame this study. Still, there is a definite demarcation in space capabilities between China and Russia, and other nations. Hence, this work will focus on the United States' two closest competitors, realizing that the European Space Agency is also a near-peer and that other nations, too, could one day join the cohort of spacefaring nations.[104]

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reasoning almost entirely on the use of force. Paradoxically, while force seemingly proves more useful in the highly contested space environment, force may have the antipodal effect as will be explained in Chapter 3.

102. Sharon Weinberger, "Plans to Put Marines in Space," *Popular Mechanics,* 14 April 2010, http://www.popularmechanics.com/technology/military/planes-uavs/plans-for-marines-in-space.

103. Jana Honkova, *The Russian Federation's Approach to Military Space and Its Military Space Capabilities,* (Washington, DC: George Marshall Institute, November 2013), 1; Brian Harvey, *China's Space Program: From Conception to Manned Spaceflight,* (Chichester, UK: Praxis Publishing, 2004), 291.

104. Robert C. Harding's, *Space Policy in Developing Countries: The Search for Security*

The Russian space program is in many ways well-known. The former Soviet Union was one of two primary antagonists in the Soviet-American space race that raged from the late 1950s until the end of the Cold War. The United States' singular focus on the Soviet space program during this period provided familiarity. Familiarity also stems from the current Russian-American working relationship aboard the International Space Station and the *Mir* space station before it. Since 1995, the United States and Russia have collaborated to expand the body of scientific knowledge.[105] Moreover, the United States' reliance on Russian spacelift creates another avenue for socialization and familiarity.[106]

Cooperation, though, does not best friends make. Despite the working relationship on the International Space Station, "Russia is investing a significant amount in [space] with the clear goal of closing the gap" with the United States, "perhaps to get ahead of the world's sole superpower."[107] "Russian strategists and theorists recognize the importance of space to modern warfare, and therefore will likely advocate [for] further investments" in space capabilities.[108] To that end, Russia has revitalized its anti-satellite programs. At the same time, Russia has tried prohibiting the United States from fielding anti-satellite systems via the Sino-Russian introduced *Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force Against*

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and Development on the Final Frontier, examines the space policies and actions of other space actors. To Harding, the world is witnessing a host of emerging space actors because nations recognize "the benefits of a successful space program includ[ing] advanced communications, a platform for technology improvement, greatly enhanced geographic information, and, for some, expanded defensive and intelligence capabilities. Equally important, space programs can provide the host state with increased international prestige, which accrues both domestic and international advantages. Hence, developing countries are merely being rational state actors and following the path pioneered by those space-faring states that preceded them." Harding codes emerging space actors into three bins based on how advanced each nation's technology is. It is worth noting that he characterizes Japan as second-tier, yet the 2008 decision by the Diet to allow military uses of space could change that ranking.

105. "Mir Space Station," NASA, 2016, Accessed 23 February 2016, http://history.nasa.gov/SP-4225/mir/mir.htm.

106. Jeff Foust, "Space Launch Capabilities and National Strategy Considerations," *Astropolitics* 8, (December 2010): 176.

107. Honkova, *The Russian Federation's Approach to Military Space and Its Military Space Capabilities,* 1.

108. Honkova, *The Russian Federation's Approach to Military Space and Its Military Space Capabilities,* 8.

Outer Space Objects to the Conference of Disarmament in Geneva.[109] While Russia has not taken advantage fully of its capabilities, there is a gap between its stated policy and actual technology. Russia will continue competing with the United States.

> The Russian approach to outer space must be considered in the context of Russian strategic culture and identity. Given the military importance of space and prestige associated with it, Russia's militarized strategic culture, its identity as a leading military great power, and its constant fear of being attacked, all of which point to the need for unchallenged superiority, we should not be surprised that Russia views outer space as an arena of strategic competition.[110]

When contemplating whether or not the USAF should build an astronaut corps, the question is not only what threats will it offset, or what capabilities will the force provide, but also how will such an action be viewed by potential adversaries? That Russia views itself in a constant competition should give the USAF and the United States a reason to pause before proceeding toward an Airmen astronaut force.

Whereas Russia presents a well-known, competitive space actor, the United States has less insight on the Chinese and their space program. As Brian Harvey, an expert on the Chinese space program, states, "China became, with its first manned spaceflight, the world's third most prominent spacefaring nation, following the original space superpowers of Russia and the United States."[111] While relegation to a follower status has not engendered the same competitive attitude in the Chinese as it did with the Russian space program, there is a palpable sense that the Chinese view the Sino-American relationship as competitive rather than cooperative. Evidence for such an assertion is paradoxically vague but easy to conclude. In April 2006, Chinese reticence to share information stymied attempts at opening dialogue on the two nations' space programs due to "Chinese military sensitivities about sharing space

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109. Honkova, *The Russian Federation's Approach to Military Space and Its Military Space Capabilities,* 9.
110. Honkova, *The Russian Federation's Approach to Military Space and Its Military Space Capabilities,* 41.
111. Harvey, *China's Space Program: From Conception to Manned Spaceflight,* 291.

technology."[112] This reticence should not surprise the reader. Many experts believe the "dominant force influencing China's space policy" is the People's Liberation Army, which intentionally wraps details on military space efforts in a "shroud of mystery."[113] According to a 2015 RAND study, the United States, knows "very little about how the Chinese government or the People's Liberation Army evaluates military capabilities, much less how Chinese leaders view their country's current capability to undertake particular missions in the face of US opposition." In private comments, however, senior Chinese officials voice an increased confidence in their nation's space capabilities.[114]

From where does the confidence come? Obviously, becoming the third nation to launch astronauts into orbit aboard indigenous crafts is one part. China's increasingly capable anti-satellite systems give the Chinese confidence and engender fear among the international community.[115] Beyond the news-making anti-satellite tests, the Chinese have pursued programs that will offset advantages the United States currently possesses.[116] Moreover, the People's Liberation Army recently moved its space program under the Strategic Support Force, or the third of three, major branches of the Army signaling the importance of space to the Chinese.[117] Yet, China's progress relative to the United States is not limited to military capability. There are also aspects of its space program that could diminish American prestige. With the on-going "hiatus in US manned spaceflight capability," there is a concern among experts

112. Moltz, *Politics of Space Security,* 288.
113. Matthew M. Schmunk and Michael R. Sheets, *challenges in the Multipolar Space-Power environment,* (Maxwell AFB, AL: Air University Press, 2007), 13; Erik Seedhouse, *The New Space Race: China vs. USA,* (Chichester, UK: Praxis Publishing, 2010), 40, 214.
114. Eric Heginbotham*, et al.*, *The U.S,-China Military Scorecard: Forces, Geography, and the Evolving Balance of Power, 1996-2017,* (Santa Monica, CA: RAND Corporation, 2015), 344.
115. Zachary Keck, "China Secretly Tested an Anti-Satellite Missile," *The Diplomat,* 19 March 2014, Accessed 7 May 2016, http://thediplomat.com/2014/03/china-secretly-tested-an-anti-satellite-missile/.
116. Heginbotham*, et al.*, *The U.S,-China Military Scorecard: Forces, Geography, and the Evolving Balance of Power, 1996-2017,* 245-258.
117. "China's Strategic Support Force: The New Home of the PLA's Cyber Operations?," Council on Foreign Relations, 20 January 2016, Accessed 7 May 2016, http://blogs.cfr.org/cyber/2016/01/20/chinas-strategic-support-force-the-new-home-of-the-plas-cyber-operations/.

that China could take the lead in the space race by beating the US in getting back to the Moon and in getting to Mars.[118]

How should the United States respond to the potential threats to American space capabilities and prestige? Although space may no longer be considered America's backyard, China is cautious about appearing too aggressive.[119] To that end, an effective strategy may be to increase Chinese uncertainty.[120] One way to do that may be to put military astronauts on orbit. Control centers, not unlike Friedman's Battle Stars, may negate Chinese efforts to thwart American space systems. More importantly, the presence of military astronauts would influence prestige and relationships in the international order. The author will explore this idea in further detail in the next chapter.

Natural Threats

Security threats are not the only threats the United States may face in space. Simply, space is cold, expansive, and full of cosmic radiation. The author does not intend to explain the science behind this assertion, but rather aims to highlight what could be the biggest obstacle to creating a USAF astronaut corps. That obstacle is space itself.

Even if national security requirements dictate building a military astronaut force, physics may make the proposal untenable. For example, with current technology, the voyage to Mars would take nearly six months.[121] Thus, developing technology that could enable a successful rescue of tourists in low-Earth orbit may not be capable of rendering assistance to the Mars One cohort (should they accomplish their goal). A spaceplane in the ilk of the SUSTAIN concept may prove quite capable of delivering combat capability anywhere in the world in under two hours, but will other missions be possible? These issues are akin to trying to make a multirole aircraft excellent at all roles and missions, but on a grander scale.

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118. Seedhouse, *The New Space Race: China vs. USA,* 45, 47; Piantadosi, *Mankind Beyond Earth,* 14, 92, 205.
119. Seedhouse, *The New Space Race: China vs. USA,* 223; Heginbotham, *et al.*, *The U.S,-China Military Scorecard: Forces, Geography, and the Evolving Balance of Power, 1996-2017,* 344.
120. Heginbotham, *et al.*, *The U.S,-China Military Scorecard: Forces, Geography, and the Evolving Balance of Power, 1996-2017,* 344-348.
121. Piantadosi, *Mankind Beyond Earth,* 189-190.

It is not just that distance makes everything more difficult in space, it is also the fact that humans are incredibly vulnerable within the space environment. Health risks, such as the threat of cosmic radiation, pose one of many threats to humans in space and will have to be considered in conjunction with doctrinal and force structure development of any potential USAF astronaut corps.[122]

Conclusion

This chapter has walked the reader through a brief history of the international space policy of two major United Nations' treaties (the Outer Space Treaty and Moon Treaty) and showed how those documents informed many American space policies. While national space policies remained relatively constant throughout the years, the strategic environment has not. Space is more contested and competitive than ever before. Amidst this challenging environment, current, planned, and potential American space missions operate. Despite the challenges associated with operating in space, current missions likely do not support constructing a USAF astronaut corps. Evidence, however, suggested that commercial space endeavors could someday necessitate the cultivation of a USAF astronaut corps to perform rescue and protection functions. Military activities also highlighted a potential need for future space rescue as well as the potential usefulness of astronauts as part of a space weapon system. The military mission of orbital repair, however, will likely be obviated by autonomous robotic systems.

American missions are not the only factors influencing the need for USAF astronauts. Actions by other space actors, such as Russia and China, indicate that the United States is, indeed, participating in a competition and must be aware of attempts to offset its advantages. If other space actors were not threatening, then space, itself, most certainly is.

Taken together, the strategist must consider some implications for national security. First, the introduction of a military astronaut corps would seemingly invigorate the industrial base of the United States, thus meeting the

122. Piantadosi, *Mankind Beyond Earth,* 169-187.

intent of the National Space Policy. The construction of such a corps must follow progress in other space endeavors to merit building said corps. Second, the potential for incredible advances in commercial space missions is nearly immeasurable. The USAF must pay attention to these advances as the possible gaps highlighted here could materialize. An astronaut corps may fill those gaps. Finally, the United States is still the leading spacepower, but its leadership is contested. While national policy seeks to encourage cooperation, not all nations share that sentiment. How the United States will respond to the challenges in the next few decades will affect that leadership. The following chapter will analyze how America's standing among the international order could be affected by building a military astronaut corps. The author will test this study's hypothesis via an examination of the concept of Airmen astronauts through a theoretical lens.

Chapter 3

Through the Looking Glass: Theory-Based Implications of an Air Force Astronaut Corps

Explanation is the soul of theory. It may be the product of repetitive observation and imaginative analysis as Nicolaus Copernicus' was, or of 'intuition, supported by being sympathetically in touch with experience,' as Albert Einstein's was. In either case, theory without explanation is like salt without savor – it is worthy only of the dung heap.

Harold Winton

Introduction

The first 50 years of humankind's Space Age displayed a duality of competition and cooperation.[1] The dualism was at times monadic as competition arose from within collaborative initiatives. The political value found in gaining allies and building new technologies during a time of competition came about, in part, because of outward motions that espoused a cooperative spirit.[2] Competition has increased as the human race embarks upon its second 50 years of spacefaring. The arrival of more space actors onto the scene, each maneuvering for limited orbital space, thickens the competitive ether.

At the same time that competition increases, there are also new endeavors that promise opportunities for cooperation through civil efforts and commercial ventures. As James Moltz suggests, "Space's second fifty years may look very different because of this greater diversity of actors and their impact on practical dynamics."[3] Robert Pfaltzgraff, in *Toward a Space Power Theory*, writes, "We do not currently know whether outer space will reinforce the

1. See Everett C. Dolman, *Astropolitik: Classical Geopolitics in the Space Age,* (London, England: Frank Cass, 2001), 238; Mark Erickson, *Into the Unknown Together - The DOD, NASA, and Early Spaceflight,* (Maxwell AFB, AL: Air University Press, 2005), 678; Peter L Hays, *Space and Security: A Reference Handbook,* (Santa Barbara, CA: ABC-CLIO, 2011), 304; David N. Spires, *Beyond Horizons: A Half Century of Air Force Space Leadership,* Revised ed. (Maxwell AFB, AL: Air University Press, 2004), These authors offer insight into the cooperative spirit extant between the Soviet Union and the United States during portions of the so-called Space Race. They assert that the cooperation was nothing more than a guise for the underlying competition between the two superpowers.
2. Dolman, *Astropolitik: Classical Geopolitics in the Space Age,* 168-172.
3. James C. Moltz, *The Politics of Space Security: Strategic Restraint and the Pursuit of National Interests,* 2nd ed. (Stanford, CA: Stanford Security Studies, 2011), 6-7.

competitive dimension or create the need for greater cooperation within and among the emerging entities that will populate space. We may hypothesize that the demands of life in outer space may enhance the need for cooperation, but we may also consider the pursuit of clashing interests between contending groups for control of key space geopolitical positions and assets."[4]

Ultimately, whether amidst a cooperative milieu or a competitive maelstrom, the USAF and the nation must consider the factors, which could necessitate building a military astronaut corps. The preceding chapter expounded on but a few real-world considerations that could merit USAF astronauts. The list was by no means exhaustive, nor could it be, because the proposition requires predicting the future. Try as the strategist may, highly accurate prognostication is a product of fancy imagination. The material considerations, though, may be less important in considering this work's hypothesis. The international political realm, with the associated normative values, rules, accepted practices, and perceptions, bears significant influence on the decision to build a USAF astronaut corps. "People are constantly changing and redefining their relationships based on the practices and rules that they create. Therefore, they are free of the material inanimate factor[s]"[5]

Accordingly, this chapter will explore the ramifications of a USAF astronaut corps as viewed through two primary spacepower theory lenses. Of course, the question arises: why discuss theory? While military professionals often ask the "how" of orders, they rarely ask the "why."[6] Theory, "explains the nature and basic functioning of its subject."[7]

> The insights gained and garnered by the mind in its wanderings among basic concepts are benefits that theory can provide. Theory cannot equip the mind with formulas for solving problems, nor can it mark the narrow path on which the sole solution is supposed to lie by planting a hedge of principles on either side. But it can give the mind insight into the great mass of phenomena and of their relationships, then leave it free to rise into the higher

4. Robert L. Pfaltzgraff, Jr., "International Relations Theory and Spacepower," in *Towards a Theory of Spacepower*, ed. Peter L Hays, and Charles D Lutes (Washington, DC: National Defense University Press, 2007), 41.
5. Pfaltzgraff, "International Relations Theory and Spacepower," 42.
6. Colin S. Gray, *The Future of Strategy,* (Cambridge, England: Polity, 2015), 43.
7. Gray, *The Future of Strategy,* 2.

> realms of action. There the mind can use its innate talents to capacity, combining them all so as to seize on what is right and true as though this were a single idea formed by their concentrated pressure—as though it were a response to the immediate challenge rather than a product of thought.[8]

Theory lights the way for the strategist.[9] Moreover, strategy is a bridge between policy and capability, as Colin Gray intimates.[10] Theory illuminates both embankments, helps the strategist avoid falling into the abyss, and provides the necessary materials to span the gap between the two sides. Accordingly, discussing spacepower theory will help the student of strategy place the concept of military astronauts within the appropriate context and to understand better how spacepower fits within the overarching concept of grand strategy.

This work also discusses theory because "theory serves a useful purpose to the extent that it can collect and organize the experiences and ideas of other men, sort out which of them may have a valid transfer value to a new and different situation, and help the practitioner to enlarge his vision in an orderly, manageable, and useful fashion."[11] Put simply, discussing spacepower theories reveals how people think about strategy and policy in space. As Alexander Wendt states, the international order may not be constructed by "ideas all the way down;" however, history and ideas matter.[12] History and ideas shape theory.[13] The theories on spacepower may not be "real and tangible," but the ideas behind them are real.[14] Recognizing others may not view one's actions through the same lens is critical. The art of making strategy requires accounting for outside parties and their interaction with the strategy bridge. Failure to do so can allow outside forces to impart destructive vibrations upon

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8. Carl von Clausewitz, *On War,* Reprint ed. trans. Michael Howard and Peter Paret (Princeton, NJ: Princeton University Press, 1989), 578.
9. Clausewitz, *On War,* 141.
10. Gray, *The Future of Strategy,* 25.
11. Rear Adm. Joseph C. Wylie, *Military Strategy: A General Theory of Power Control,* (Annapolis, MD: Naval Institute Press, 1989), 31.
12. Alexander Wendt, *Social Theory of International Politics,* (Cambridge, England: Cambridge University Press, 1999), 109, 371.
13. Clausewitz, *On War,* 141; Wylie, *Military Strategy: A General Theory of Power Control,* 31.
14. Wylie, *Military Strategy: A General Theory of Power Control,* 31.

strategy's structure. Builders of strategy must account for the structure's natural frequency lest structural resonance destroy the strategy bridge, much like the Tacoma Narrows Bridge.

Therefore, even if material reality requires USAF astronauts to serve the nation, the international political consequences could negate any advantage of doing so. The intent of this chapter is to anticipate what those consequences could be. To accomplish this end, the author will review spacepower theory and its main schools of thought. Then, the author will propose a synthesis of the theoretical camps with the goal of arming the reader with a thorough understanding of theory's illuminative power. Finally, the author will use the synthesized theoretical viewpoint to analyze the various missions and roles a USAF astronaut could perform. Specifically, the author will analyze the theoretical consequences of an astronaut corps via two facets: first, as part of a space weapon system; second, in the context of a space police force with primary roles in the areas of space rescue in addition to policing. The theoretical analysis of two broad and different mission areas and functions can arm senior leaders with an understanding of what an Air Force astronaut would mean for national security.

Spacepower Theory and its Schools of Thought

The concept of spacepower theory has roots in international relations.[15] As Robert Pfaltzgraff reasons, "Because all international relations theories either describe or prescribe interactions and relationships, space becomes yet another arena in which to theorize about the behavior of the world's political units."[16] Furthermore, humankind has not yet inhabited anything beyond low-Earth orbit, and in this case, only on the smallest of scales. There are no empirical observations, then, of human behavior beyond Terra to fully theorize how the concepts of cooperation, competition, self-interest, and distribution of capabilities will play out. Consequently, spacepower theories not only derive from international relations theories; spacepower theories inform thinking about "the near-term space issues, notably how space shapes the power of

15. Pfaltzgraff, "International Relations Theory and Spacepower," 29.
16. Pfaltzgraff, "International Relations Theory and Spacepower," 29.

Earthly states."[17] Thinking "first about the extension of capabilities of states into space as a basis for enhancing their position on Earth," elucidates the potential for how "sociopolitical relationships might evolve between space-based entities far from Earth."[18]

The Major Schools

International relations theory proposes three major sects of thought: Realism, Liberalism, and Marxist-Socialism.[19] Despite the existence of such a triad, this paper will analyze the null hypothesis through two lenses: Realism and Liberalism. Part of this choice is for simplification of analysis; evaluating the concept and the theory-based implications for Airmen astronauts through the tenets of Marxist-Socialism was beyond the scope of this monograph. Still, there was another reason the author excluded Socialism. While there are at least three major schools of international relations theory, only Realism and Liberalism have true offspring in spacepower theory.[20] Distilling down to just

17. Pfaltzgraff, "International Relations Theory and Spacepower," 30.
18. Pfaltzgraff, "International Relations Theory and Spacepower," 30.
19. Michael W. Doyle, *Ways of War and Peace: Realism, Liberalism, and Socialism,* (New York, NY: W. W. Norton & Company, 1997), 560; Everett Dolman and Henry F. Cooper Jr., "Increasing the Military Uses of Space," in *Towards a Theory of Spacepower,* ed. Peter L Hays, and Charles D Lutes (Washington, DC: National Defense University Press, 2007), 375. There may even be a fourth school, Constructivism. Constructivism argues that material forces account only for objective reality. The distribution of capabilities and self-interest do not give agency to the structure of the international order. That is, Realists suggest that self-interest in a world of anarchy generally forces a state to act a certain way. There is choice involved, but choosing not to do what the system suggests results in extinction of the state. Instead, a constructivist acknowledges that material needs are caused and constituted by ideas and that it is ideas that give form to the international order. Self-interest is still a driver, but because ideas change, interests can too. See Wendt, *Social Theory of International Politics,* 447. On constructivism, Pfaltzgraff writes, "Constructivism is not a theory, but instead an ontology, an understanding of the nature of being, a way of looking at the world. The world is constantly being "constructed" and therefore changed as new geopolitical, geoeconomic, or geostrategic changes take place." See Pfaltzgraff, "International Relations Theory and Spacepower," 41. Interestingly, Pfaltzgraff makes no mention of Marxist-Socialism. One can quickly ascertain that the number and label of schools, while not quite correspondent to the number of scholars, is legion. See Pfaltzgraff, "International Relations Theory and Spacepower," 33.
20. One could argue that global institutionalism is more social-Marxist than Liberal. The motivations for keeping the sanctuary, however, and the mechanisms for doing so, offer an incredibly large swath of possibilities as Peter Hays suggests (see Peter L. Hays, *United States Military Space: Into the Twenty-First Century,* (USAF Academy, CO: USAF Institute for National Security Studies, 2002), 98-99.) Thus, for every one social-Marxist there is a Liberal institutionalist. The preponderant view tends to favor the

two schools not only simplified the problem of analyzing the potential implications of creating a cadre off military astronauts, but doing so also remains most faithful to the major schools from which spacepower theory birthed. Moreover, the Liberal and Realist camps represent the bookends of spacepower thought.[21] Much like in international relations theory, there is a spectrum of differing ideas and concepts. Some count as many as six different branches of thought.[22] Interestingly, these schools largely center the debate on the idea of weaponizing space. On one hand, centering the debate on space weaponization makes sense. At the basest level, terrestrial international relations theories focus on the role of the state within the international community as they relate to security and self-interest. On the other hand, because space has yet to become the province of humankind, discussion about national security in terms regarding space must focus on the systems in space and their protection.[23] In other words, on Earth there are other methods to attain national interests and provide security for one's population, however, in space, the systems, which are extensions of the state and its populace, can only be secured, so it seems, through weapons. As humankind expands its province into space, the debate on security policy and strategy may evolve as Robert Pfaltzgraff suggests in his article, "International Relations Theory and Spacepower."[24] Until that time, the space arena is still "an adjunct to the security and well-being of the primary" nation. Debating the acceptability and role of space weapons remains the center point.[25]

Testing this work's hypothesis hinges on understanding the various categories of spacepower theory. As the author stated, theory categorizes.[26]

Liberal view.

21. Pfaltzgraff, "International Relations Theory and Spacepower," 29-43.

22. Most authors describe four schools while Dolman describes two as will be explained, and Karl Mueller describes six in Karl P. Mueller, "Totem and Taboo: Depolarizing the Space Weaponization Debate," in *Space Weapons: Are They Needed?*, ed. John M. Logsdon, and Gordon Adams (Washington, DC: Space Policy Institute, 2003), 1.

23. Moltz, *Politics of Space Security,* 40. Moltz mentions the closer relationship space has to national security right now and how that relationship affects the debate on weaponizing space.

24. Pfaltzgraff, "International Relations Theory and Spacepower," 30.

25. Pfaltzgraff, "International Relations Theory and Spacepower," 31.

26. Admittedly, such an exercise reminds the author, a mathematician, that categorizing requires a simplification. The author has attempted to keep the key tenets

Spacepower theory is no different. In discussing each major category of spacepower thought, one will appreciate better where each school falls along the spectrum between Realism and Liberalism.[27] While space as sanctuary and space as high-ground constitute the end points, the other schools fill in the spectral gaps. Any student of space strategy will recognize these schools, yet the descriptions contained herein represent amalgamations of various scholarly writing based on this author's interpretation.

Sanctuary and the High-Ground

Everett Dolman, in his path-blazing *Astropolitik*, builds his spacepower theory on the foundation of geopolitics, explaining that there are two main schools of space strategic thought. Those schools are: "space as strategic sanctuary and space as the ultimate high ground."[28]

Sanctuary (Global Institutionalism). The space as sanctuary camp argues that since space is, as the Outer Space Treaty and Moon Treaty espouse, the province of humankind, meant for the benefit of all, then "space is a sanctuary from the evils of this planet."[29] To some, sanctuary equates to no militarization, however, Sputnik irrevocably opened Pandora's box with respect to militarization.[30] Space has been militarized from the beginning. Ever since the United States' Project Vanguard, the nation has sought to benefit from the notion that space was a sanctuary that enabled free overflight. To wit, space offers "the capability to 'see' within the boundaries of sovereign states. This value stems from the space vehicle's legal overflight characteristic."[31] Such

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to retain the structure of each school and to avoid the mistake of reducing to a single monad.

27. The schools of thought act as foundations upon which various spacepower theories were built. In the following two sections, this work will delineate four different schools of thought. The reader is cautioned that agreement about the general characteristics of each school exists, but given two scholars, one will quickly find minor differences in each scholar's description of the schools.

28. Dolman, *Astropolitik: Classical Geopolitics in the Space Age,* 150.

29. Dolman, *Astropolitik: Classical Geopolitics in the Space Age,* 149.

30. While Sputnik was little more than an orbital transponder, Sputnik's flight answered the question of how the Soviet Union would handle overflight rights when the United States eventually launched its satellites. In a serendipitous manner, Sputnik opened the door for the Corona spy satellite program. See Dino A. Brugioni, *Eyes in the Sky: Eisenhower, the CIA and Cold War Aerial Espionage,* (Annapolis, MD: Naval Institute Press, 2010), 246-249, 361-373.

31. David E. Lupton, *On Space Warfare,* (Maxwell AFB, AL: Air University Press, 1998),

overflight was, and still is, critical to key missions such as strategic reconnaissance and treaty verification.[32] Since space has been militarized from the start, sanctuary school adherents, instead, assert that the best course of action is to prevent the weaponization of space.[33] Space should be upheld as a sanctuary, because the very notion of weaponizing presents a countervailing force to any nation's attempts to attain space security. As Joan Johnson-Freese attests, attempts to bolster security through weaponization prove counterproductive. Such attempts tighten the spiral of a security dilemma.[34] In essence, the sanctuary school proclaims that the benefits of maintaining the peaceful "province of mankind" far exceed the perceived advantage of weaponizing actions. The ideals of this school are self-evident, but a major question remains. Will international norms and rules be enough to preserve space for "peaceful purposes" or is a guardian required?

High-Ground (Space Nationalism). Contrary to arguments supporting the idea of protecting the sanctuary of space, the high-ground, or space nationalism, cohort espouses seizing the strategic advantage the high-ground affords even if doing so requires weaponizing space. In space, whoever controls the high ground, will control near-Earth space, and consequently, the Earth itself.[35] In part, the advantage of the space high-ground parallels the benefits afforded to the infantry unit perched atop the ridge sitting between the enemy and its objective. The enemy must fight uphill where it naturally must expend more energy and lose a key vantage point in doing so. John Klein explains the benefits of space's high-ground found in the energy differentials caused by Earth's gravity well and the field-of-view sitting atop orbit provides.[36] This study suggests another advantage, which closely parallels the gravity well phenomenon. Klein's barrier of space, akin to the ridge in the above example,

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32. Hays, *Space and Security: A Reference Handbook,* 10; Walter A. McDougall, *The Heavens and the Earth: A Political History of the Space Age,* (Baltimore, MD: Johns Hopkins University Press, 1997), 127-130; John J. Klein, *Space Warfare: Strategy, Principles and Policy,* (Hoboken, NJ: Routledge, 2012), 17.
33. Dolman, *Astropolitik: Classical Geopolitics in the Space Age,* 149-151; Joan Johnson-Freese, *Space as a Strategic Asset,* (New York, NY: Columbia University Press, 2007), 133.
34. Johnson-Freese, *Space as a Strategic Asset,* 10, 93, 238, 243.
35. Dolman, *Astropolitik: Classical Geopolitics in the Space Age,* 8.
36. Klein, *Space Warfare: Strategy, Principles and Policy,* 86-87.

affords protection to the one holding the high-ground simply because any enemy must traverse the barrier before getting to one's forces.[37]

While space may present the ultimate high-ground replete with the high-ground's advantages, seizing the high-ground not only could engender a security dilemma, sitting atop the perch also makes enemy attempts to target one's forces far easier. Whether silhouetting along the top of the ridge line or tracing predictable pathways on orbit, the high ground can make one's forces vulnerable. Nevertheless, this school recognizes the inherent advantages of the high-ground, whether as an offensive means to execute space-to-ground attacks or as a defensive measure as part of an anti-ballistic missile system.

Within the high-ground camp, however, there is no homogeneity of thought. Most high-ground adherents believe in the inevitability of space's weaponization. The difference lies in how to respond to the inevitability. For Dolman, the United States should seize the initiative and weaponize now lest a fleeting opportunity pass.[38] Conversely, Michael O'Hanlon and John Klein admit that weaponization may be inevitable, but a measured approach that accounts for international reactions and net security gains is best.[39] For O'Hanlon and Klein, "slow and steady goes a lot farther in space, than haste and waste;" rapid weaponization by the United States could engender a counterproductive security dilemma in response to the nation's actions.[40] Regardless, if a USAF astronaut corps were built along the lines of Dolman's theory or more along the "inevitable, but delay the inevitability as long as possible" group, an important question arises. Would placing military

37. Klein, *Space Warfare: Strategy, Principles and Policy,* 100-106.
38. See Dolman, *Astropolitik: Classical Geopolitics in the Space Age,* 149, 154-155, 175. Note: Dolman's high-ground school of thought divides space theory into sanctuary and high-ground camps. He is the exception, as this thesis will explain. In fact, Dolman's high-ground is what James Moltz, in *Politics of Space Security*, calls space nationalism. See Moltz, *Politics of Space Security,* 400.
39. Michael E. O'Hanlon, *Neither Star Wars nor Sanctuary: Constraining the Military Uses of Space,* (Washington, DC: Brookings Institution Press, 2004), 119-142; Klein, *Space Warfare: Strategy, Principles and Policy,* 144-148. Both O'Hanlon and Klein straddle the high-ground and technological determinist camps. They recognize the value of space's high-ground like Dolman but believe that weaponizing space and seeking the high-ground should be a measured process if followed at all. Because these two scholars have feet in both camps, this study discusses their ideas in both schools of thought.
40. Claude A. Piantadosi, *Mankind Beyond Earth: The History, Science, and Future of Human Space Exploration,* (New York, NY: Columbia University Press, 2012), 40.

astronauts on orbit take advantage of the high-ground or add to vulnerabilities in the American space system?

Two Divides into Four

If the high-ground and space as sanctuary schools represent the two bookends for strategic thought and form the foundation for existing spacepower theories, then the next two schools both take steps towards the middle ground while retaining essential elements of Liberal or Realist thought. As James Moltz notes, these schools are smaller and more nuanced than the two poles of the high-ground and sanctuary schools.[41]

Technological Determinism (Inevitable Weaponizer/Control). The technological determinist view holds that weaponization of space is likely inevitable. In contrast with the high-ground or nationalist viewpoint, however, this school believes that the "permanent basing of weapons in space should be delayed as long as possible."[42] This belief hinges on the assumption that spacefaring nations are "self-interested rational actors" that make "decisions according to shifting economic and strategic calculations."[43] One such calculation concerns the pace of space's weaponization. As Peter Hays puts it, "[nations] are not convinced that space weaponization would be beneficial for…global security and they are unsure that space will prove to be the decisive theater of combat operations."[44] Thus, this school takes a pragmatically "nuanced view of space arms control and regulation," and because weaponization appears to be inevitable, the school advocates taking adequate measures to preserve American control of space should warfare extend to the ethereal domain.[45] National interest implies that weaponizing space is not necessarily the best method for accruing spacepower; however, the school sees arms-control-only approaches "as futile or even dangerous due to their potential to lull the United States into complacency or otherwise cause it to be

41. Moltz, *Politics of Space Security,* 23.
42. Klein, *Space Warfare: Strategy, Principles and Policy,* 141. As mentioned, Klein's ideas do not fit neatly into just one school of spacepower thought.
43. Moltz, *Politics of Space Security,* 34.
44. Hays, *United States Military Space: Into the Twenty-First Century,* 98.
45. Hays, *United States Military Space: Into the Twenty-First Century,* 98; Johnson-Freese, *Space as a Strategic Asset,* 132-133; O'Hanlon, *Neither Star Wars nor Sanctuary: Constraining the Military Uses of Space,* 20, 117, 121, 141-142.

outmaneuvered by states that successfully circumvent space weaponization accords."[46] While the United States should not hasten weaponization through its efforts, weaponization is inevitable and should be accounted for in policy and strategic thought, according to technological determinists.

Arms Control (Social Interactionism/Military Realism/Survivability). The final school of thought also takes a pragmatic approach in viewing spacepower theory in general, and weaponization of space in particular. Where the inevitable weaponization school belied a Realist approach, the arms control school is more Liberal in nature.[47] This school rejects "the notion of the inevitability of space weapons," and like the technological determinists, believes weaponizing space will prove counterproductive.[48] This assertion stems from the fact the United States "has more space assets in orbit than any other country," therefore, the nation has more to lose if space suddenly became a war ground.[49] Consequently, the arms control school recommends "viewing space security from the perspective of self-interested actors seeking to protect their access to space in a gradually constricting collective goods environment."[50] Leaders can "influence military trends in a purposeful manner through interactions," or cooperative efforts.[51] This idea of social interactionism "support[s] space-related arms control and regulation that precludes other states from weaponizing or even militarizing space. Most of [the school] believe, however, that this support must be balanced against the increased attention that formalized arms control efforts could draw to the United States' already formidable space-enabled force enhancement capabilities and the political, military, and arms control fallout this increased scrutiny might cause."[52] Transparency and confidence-building measures could help deflect such scrutiny. Overall, this school, like Realism, acknowledges the primacy of a

46. Hays, *United States Military Space: Into the Twenty-First Century,* 98-99.
47. The school is also known as the social interactionist, military realist (little "r" as opposed to big "R" Realists as described earlier), or the survivability school.
48. Moltz, *Politics of Space Security,* 37-38. Regarding the assertion that weaponization is inevitable, Joan Johnson-Freese asks, "what in history has proved to be inevitable beyond death and taxes?" See Johnson-Freese, *Space as a Strategic Asset,* 133.
49. Johnson-Freese, *Space as a Strategic Asset,* 133.
50. Moltz, *Politics of Space Security,* 40.
51. Moltz, *Politics of Space Security,* 39.
52. Hays, *Space and Security: A Reference Handbook,* 87.

state's self-interest. Additionally, like Realism, the school takes a pragmatic approach. Social interactionism advocates for strategic hedging by making systems more survivable and by developing capabilities that meet future challenges, all while avoiding provocative measures that become self-fulfilling prophecies.[53] The difference between what this study calls Pragmatic Realism (Technological Determinism) and Pragmatic Liberalism (Arms Control) is the vehicle used to obtain those interests. Arms control favors institutions, norms, and the rule of law to preserve space for the use of all humankind while stopping short of the sanctuary of global institutionalism.

Astronauts as Space Weapons

There are two broad, potential mission areas for any proposed USAF astronaut corps. The first of these roles entails using the astronaut as part of a space weapon system. While the current debate on weaponizing space excludes manned weapon systems (with the notable exception of the Marines' SUSTAIN, which is arguably a terrestrial system that merely touches space), such a system is not outside the realm of possibility in the future.[54] To that end, the reader is asked to suspend their disbelief. In doing so, the one is positioned better to appreciate the argument the author creates regarding the theoretical implications of a military astronaut corps performing the role as operator of space weapons. Whether these systems take the form of the George Friedman's Battlestars or embody scores of space troopers is immaterial to the argument.[55] What is salient is that the USAF and nation must consider what role a military astronaut would perform should such a force be constructed.

> At a fundamental level, virtually all issues of space strategy turn on broad questions related to weaponizing space such as whether

53. Johnson-Freese, *Space as a Strategic Asset,* 247-248; Michael Krepon, Theresa Hitchens, and Michael Katz-Hyman, "Preserving Freedom of Action in Space: Realizing the Potential and Limits of U.S. Spacepower," in *Towards a Theory of Spacepower*, ed. Peter L Hays, and Charles D Lutes (Washington, DC: National Defense University Press, 2007), 397-398.
54. Sharon Weinberger, "Plans to Put Marines in Space," *Popular Mechanics,* 14 April 2010, http://www.popularmechanics.com/technology/military/planes-uavs/plans-for-marines-in-space.
55. George Friedman, *The Next 100 Years: A Forecast for the 21st Century,* (New York, NY: Doubleday, 2010), 184-185.

> space will be weaponized, how that might happen, which states and other actors might be most interested in leading or opposing weaponization, and how any of these space weaponization issues might best be controlled. At the political level, there is, of course, a broad spectrum of opinion on these issues[56]

The Realist school of thought, for the most part, constitutes the weaponization end of the spectrum. As discussed earlier, this work, to simplify analysis, combined the space as the high-ground or nationalist group with the neorealist, technological determinist, or inevitable weaponizers.[57] While Everett Dolman's work, *Astropolitik*, indeed presents the logical extreme of geopolitics in space, there are also underlying nationalist tones in the likes of John Klein's Corbettian and Brent Ziarnick's Mahanian spacepower theories. Moreover, the two distinct groups (nationalist and technological determinist) believe in the inevitability of space's weaponization. Therefore, it is reasonable to combine the schools for this study despite the differing opinions on how soon "inevitable" really is.

Accordingly, if the USAF were to use astronauts as space troopers, what could be the repercussions? From the Realist school, placing USAF astronauts on orbit could provide many benefits. First, if Dolman's *Astropolitik* model is valid, USAF astronauts could operate a low-Earth orbit weapon system used to deny threatening entities access to space.[58] In other words, military astronauts could be used to seize low-Earth orbit and then act as the gatekeeper to the heavens.[59] The merits of creating such a system, however, are tenuous as will be discussed. Yet, if conditions were amenable to such a system, then using military astronauts as space soldiers follows logically. That is, if the future international environment were one of "continued nationalist military and economic competition," and the United States needed an efficient ability to "harness the positive motivations of individuals and states striving to better their conditions," then space soldiers should probably be part of the solution.[60]

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56. Lupton, *On Space Warfare,* 98.
57. Lupton, *On Space Warfare,* 98; Moltz, *Politics of Space Security,* 24-27, 33-37.
58. Dolman, *Astropolitik: Classical Geopolitics in the Space Age,* 61, 154, 157.
59. Dolman, *Astropolitik: Classical Geopolitics in the Space Age,* xii.
60. Dolman, *Astropolitik: Classical Geopolitics in the Space Age,* 183.

Having humans involved directly in space warfare constitutes a second benefit of using astronauts as part of a space weapon system.[61] During the 1960s, the nation and the USAF searched for ways to bolster the country's nuclear deterrent posture through ever-advanced delivery capabilities and by ensuring the continuity of the command and control of nuclear forces. Integrating humans further into the nuclear deterrence decision-making apparatus lent additional layers of judgment and adaptability.[62]

> One such area concerns future means for command and control is our global strike forces. Effective command and control of these forces is an integral component of our overall retaliatory capability, and its survivability in case of a surprise attack is, therefore, a vital element of a credible deterrent. There must be reliable two-way communications between the authorities in command of all combat forces in the field, be they underwater, on the ground, in the air, or, ultimately, in space. Because of the immense scope and world-wide deployment of these forces, there must also be extensive electronic equipment for rapid processing of all information received from them so that the command element can make instant and appropriate decisions.
>
> While these measures should insure the survivability of SAC's command and control system for some time to come, continuous improvements will be needed to keep up with any new developments that might impair the effectiveness and survivability of that system. Communication satellites offer a variety of possibilities in this respect. However, we may find that, eventually, the only really survivable command and control structure–not only for SAC but all our military forces–would be one employing a maneuverable command post in space.
>
> Should such a spaceborne command post become necessary, it would have to be large enough to carry all electronic gear required to gather, process and disseminate operational information on a global basis. Also, it would have to be capable of defending itself against any interference or attacks from the ground and space. It is inconceivable to operate such a central command post, especially one deep in space, without a skilled crew to operate and

61. This is not to suggest humans are not involved now, but that being in the medium, in a way, changes the dynamic.

62. This author takes James Moltz's definition of space weapon. To him, "space weapon is any system whose use destroys or damages objects in or from space." Moltz's definition allows for systems whose use from space allows the destruction of objects. Using military astronauts, as part of a command and control system, to direct terrestrial battles, fits his definition albeit loosely. See Moltz, *Politics of Space Security,* 43.

> maintain its complex equipment and without competent officers fully qualified to assume command of the strike forces whenever necessary. Here, then, may be the first major requirement for military men in space.[63]

General Thomas Power's quote reflected one proposed justification for putting military members on orbit--to preserve command and control of the nuclear forces in the event of general war with the Soviets. However, today's nuclear command and control system, buttressed by a robust network of satellite and terrestrial systems, seems to obviate such a justification. The Department of Defense, however, warned of an impending "Space Pearl Harbor" in the 2001 Space Commission Report. Would creating a manned orbital command and control station as part of the global nuclear deterrent force be wise?[64] The Realist camp would answer affirmatively. Doing so would be in the self-interest of the United States especially in the scenario of a surprise attack.

> "At some time in the future, the physical presence of humans in space will be necessary to provide greater situational awareness. Humans have and will continue to possess a keener ability to sense, evaluate, and adapt to unexpected phenomena than machinery. This is an important attribute in any case, but especially so as spacecraft begin to venture farther from Earth where electromagnetic signal round-trip times stretch from seconds to minutes to even hours."[65]

The logic for manned control stations extends beyond nuclear conflict. Perhaps more so in conventional conflict, manned, orbital control stations could mitigate, if not thwart, an attack against the traditional command and control systems.[66] While such a scenario seems unlikely, countries such as China actively pursue methods to deny the United States its use of space systems.[67]

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63. Thomas power, "Military Aspects of Manned Space Flight" (Address, Heterogeneous Combustion Conference, Palm Beach, FL, 11 December 1963).
64. This operating concept may not be feasible, however, there are no open source documents that refute this idea.
65. James Oberg, *Space Power Theory,* (USAFA, CO: United States Air Force Academy, 1999), 129-130.
66. Klein, *Space Warfare: Strategy, Principles and Policy,* 112-115.
67. Eric Heginbotham, *et al.*, *The U.S.-China Military Scorecard: Forces, Geography, and the Evolving Balance of Power, 1996-2017,* (Santa Monica, CA: RAND Corporation, 2015), 245-258. Note: many US command and control systems rely upon space capabilities.

Using USAF astronauts in conjunction with orbital weapon systems or command and control nodes provides a third advantage that extends beyond benefiting from the cognitive abilities of humans. An astronaut's physical presence, itself, could provide an advantage. In a strange logic that was used during the Cold War, a human presence on orbit could provide a deterrent trip wire for potential antagonists.[68] As John Klein notes, "sensational reactions and media attention" would invariably accompany an unprovoked act that placed American military astronauts at risk.[69] To that end, Everett Dolman captured the normative prohibition against targeting another nation's astronauts in his description of an *Astropolitik* strategy. To wit, a nation implementing a space blockade would require the gumption to shoot down any manned spacecraft that launched without permission from the arbiter of low-Earth orbit.[70] Admittedly, shooting down another nation's astronauts is not something readily done given the historical label of "envoys of mankind" the Outer Space Treaty bestowed upon astronauts. This author admits that suggesting using military astronauts as a trip wire is unsavory, and that is not the recommendation. Yet, the implication remains. The United States could use the legal protection of astronauts to its strategic advantage. If the USAF decides to build an astronaut corps and use them as part of a space weapon system, merely having humans in space could bolster strategic deterrence in space.

Building a military astronaut corps as part of a space weapon system would come at great financial cost. Equally important is the cost the United States would incur from the security dilemma set off by such an action. It is now to the disadvantages and pitfalls of a USAF astronaut corps that this work must turn.

One of the most readily apparent problems with proceeding toward an astronaut soldier force is the messaging such efforts would carry. Both the

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68. See Thomas Schelling's *Arms and Influence*, for a discussion on how the United States in recognizing it could not defend Europe against a Soviet ground invasion nevertheless kept a contingent in Germany. The American troops' presence provided a trip wire or "plate glass window" that bolstered the deterrence strategy of the United States

69. Klein, *Space Warfare: Strategy, Principles and Policy,* 125.

70. Everett C. Dolman, "Astropolitik: A Case for Weapons in Space" (Lecture, School of Advanced Air and Space Studies, Maxwell AFB, AL, 7 March 2016).

arms control/social interactionist and global institutionalist/sanctuary schools assert that the message would be one of menace and aggression. According to Navy Commander Andrew Dittmer and Joan Johnson-Freese, the United States, despite efforts elsewhere in the diplomatic regime, has generally encamped its space policy in the "military primacy and hegemonic attitude" camp.[71] Despite changes in the tone of the National Space Policy from 2006 to 2010, American writings, whether from think tanks or publications from professional military journals have belied a more aggressive tone.[72] Interestingly, despite Johnson-Freese's decade-old caution that any "potential for the will of the United States to become absolute is perceived as threatening to the very sovereignty of other countries," the rhetoric has not softened since.[73] Rather, to the Liberal school, America's "space policies are neither nurturing nor protective…and produce unintended consequences that can damage US space preeminence, to the overall detriment of the country."[74]

One unintended consequence is that fear of American policy implications becomes the progenitor of other states' actions, made under the belief that those actions will increase security and allay fears. In other words, a security dilemma could arise. This security dilemma is the paradox found when "many of the means by which a state tries to increase its security decrease the security of others" thereby causing reciprocal action and a net decrease in security.[75] In *Space as a Strategic Asset*, Johnson-Freese takes great care to explain how the space security dilemma worsens with poorly chosen policy words and tones that portray an aggressive rhetoric.[76] Other states feel less secure and attempt to circumnavigate the uncertainty of the international order while simultaneously

71. Andrew R. Dittmer, ""Space as a Strategic Asset"" (Lecture, School of Advanced Air and Space Studies, Maxwell AFB, AL, 11 March 2016).
72. Mariel John, *U.S. National Space Policy Comparison: Comparing the 2010 National Space Policy to the 2006 National Space Policy,* (Colorado Springs, CO: Space Foundation, 2011), ; Dittmer, ""Space as a Strategic Asset"" (Lecture, School of Advanced Air and Space Studies, Maxwell AFB, AL, 11 March 2016).
73. Johnson-Freese, *Space as a Strategic Asset,* 21; Dittmer, ""Space as a Strategic Asset"" (Lecture, School of Advanced Air and Space Studies, Maxwell AFB, AL, 11 March 2016).
74. Johnson-Freese, *Space as a Strategic Asset,* vii.
75. Robert Jervis, "Cooperation Under the Security Dilemma," *World Politics* 30(2), no. 2 (1978): 169-170.
76. Johnson-Freese, *Space as a Strategic Asset,* vii-viii.

trying to maintain security.[77] Conversely, no matter how a state views its actions, and, in some cases, explains the reason for those actions, other countries may see only aggression. Robert Jervis captured this conundrum well in his 1979 article, "Cooperation Under the Security Dilemma."

> The dilemma will operate much more strongly if statesmen do not understand it, and do not see that their arms--sought only to secure the status quo--may alarm others and that others may arm, not because they are contemplating aggression, but because they fear attack from the first state.
>
> A state which thinks that the other knows that it wants only to preserve the status quo and that its arms are meant only for self-preservation will conclude that the other side will react to its arms by increasing its own capability only if it is aggressive itself. Since the other side is not menaced, there is no legitimate reason for it to object to the first state's arms; therefore, objection proves that the other is aggressive.[78]

Thus, no matter how the United States may attempt to advertise the intended use of a USAF astronaut corps and explain motives, the action of building a manned, space weapon system could be enough to set off the vicious spiral of a security dilemma.

One of the reasons states perceive such an action as aggressive is the generally accepted, albeit increasingly challenged, norm that space should not be weaponized. In fact, "huge majority votes at the United Nations in favor of negotiating bans on space weaponry" help only to cement such norms.[79] Thus, "defending the status quo often means protecting more than territory. Non-territorial interests, norms, and the structure of the international system must be maintained. If all status-quo powers agree on these values and interpret them in compatible ways, problems will be minimized."[80] When there is a divergence in policies and a broad range of interests, the security dilemma will

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77. Johnson-Freese, *Space as a Strategic Asset,* 22, 239-240.
78. Jervis, "Cooperation Under the Security Dilemma," 181.
79. O'Hanlon, *Neither Star Wars nor Sanctuary: Constraining the Military Uses of Space,* 121. See also Moltz, *Politics of Space Security,* 326-333, 352. Moltz explains that social interaction between space-faring nations and the realization that destructive practices in space hindered rather than helped national security, ultimately gave legitimacy to the norm of the non-weaponized use of space.
80. Jervis, "Cooperation Under the Security Dilemma," 185.

be exacerbated.[81] A manned weapon system, therefore, would countervail the norm of keeping space free of weapons. The current security dilemma between the United States and near-peer spacefaring nations would likely worsen.

The security dilemma also worsens when there is an unclear delineation between offensive and defensive capabilities.

> The other major variable that affects how strongly the security dilemma operates is whether weapons and policies that protect the state also provide the capability for attack. If they do not, the basic postulate of the security dilemma no longer applies. A state can increase its own security without decreasing that of others. The advantage of the defense can only ameliorate the security dilemma. A differentiation between offensive and defensive stances comes close to abolishing it.[82]

Would a manned, space weapon system be used solely for defensive purposes, or would such an entity offer offensive advantages? Such a question will certainly materialize in the minds of other spacefaring nations and could spin off efforts to offset perceived American advantages. Equally important, if the United States could demonstrate to the international community that military astronauts only operated a purely defensive system, thus ameliorating security dilemmas, could not such a capability also be available using less costly unmanned capabilities?[83]

These questions are important because the process of answering them forces the USAF and the student of strategy to consider that using astronauts as part of a space weapon system may result in a security dilemma, thus proving counterproductive. The nation, in trying to increase its security, actually becomes less secure. That conundrum, however, is not the only unintended consequence of a manned, weapon system in space. The Liberal school would also raise the possibility of decreased prestige and world standing as a consequence. While there may be significant advantages to defecting from international norms that prevent weaponizing space, security gains must be weighed against other considerations. Temporary gains may actually sacrifice

81. Jervis, "Cooperation Under the Security Dilemma," 185.
82. Jervis, "Cooperation Under the Security Dilemma," 199.
83. Jervis, "Cooperation Under the Security Dilemma," 201.

long-term stability and prosperity due to declines in prestige as Jervis suggests. "Exploitation has at times been frowned upon by the international community, thus reducing the prestige of a state that engages in it."[84] To abandon the norms the United States helped establish would "lead to [a] loss of reputation."[85] Johnson-Freese adds, "it is sometimes more important to be feared than loved;" yet, weaponizing space may overdo such a prescription.[86] The image of America's space soldiers looming in the heavens could cloud "any positive, progressive message that the [United States] want[s] to project." Prestige and moral standing, according to the Liberal theorists, translate into political status, or soft power, that can better serve the interests of the United States.[87]

The United States, "by racing to develop its own space weapons, would cause two unfortunate sets of consequences. Militarily, it would legitimate a faster space arms race than is otherwise likely—something that can only hurt a country that effectively monopolizes military space activities today. Second, it would reinforce the current prevalent image of a unilateralist United States, too quick to reach for the gun and impervious to the stated will of other countries."[88] In seizing the heavens with military astronauts, the United States would gain the strategic high-ground by sacrificing the moral high ground.

Astronauts as Space Police

The international political order may not be ready to consider the implications of using a USAF astronaut corps as part of a weapon system. At least from a theoretical point of view, the Liberal theoretical lens highlights immediate repercussions of weaponizing space using astronauts. On the other hand, the Realist camp points to potential advantages based on assumptions that have yet to be tested. This imbalance between known negative consequences and hypothetical benefits would suggest that using astronauts as

84. Jervis, "Cooperation Under the Security Dilemma," 179.
85. Moltz, *Politics of Space Security,* 338.
86. Johnson-Freese, *Space as a Strategic Asset,* 248.
87. Johnson-Freese, *Space as a Strategic Asset,* 170, 249; Moltz, *Politics of Space Security,* 11.
88. O'Hanlon, *Neither Star Wars nor Sanctuary: Constraining the Military Uses of Space,* 121.

weapons would not serve the best interests of the United States. Is there another role that would? This work now turns to the role of astronauts as space police and addresses the theoretical implications of such an idea as well as offers suggestions for implementation.

Providing an all-encompassing list of the roles of astronauts as space police lies beyond the scope of this writing. One way military astronauts could be used in a police role would be to perform payload inspection under the auspices of the United Nations. Resolutions 62/101 and 68/74 recommend a more robust program of spacecraft registration and pave the way for future on-site inspection systems "to ensure the use of space for peaceful purposes."[89] Certainly, such inspections are better performed before launch, but having the ability to inspect systems already on orbit could prove advantageous especially when more opaque regimes attempt to sneak weapons or otherwise disruptive technology into space. Additionally, as suggested in chapter 2, space offers the potential to garner material gain if nations deem the effort worthwhile. If nations or non-state actors find ways to appropriate extraterrestrial resources, it is not overly alarmist to suggest that criminal activity will follow commercial efforts.[90] It may take time for criminals to follow, but they will.[91]

> In the past quarter century (namely, since the end of the Cold War), global governance has failed to keep pace with economic globalization. Therefore, as unprecedented openness in trade, finance, travel and communication has created economic growth and well-being, it has also given rise to massive opportunities for criminals to make their business prosper.
>
> Organized crime has diversified, gone global and reached macro-economic proportions: illicit goods are sourced from one continent, trafficked across another, and marketed in a third. Mafias are today truly a transnational problem: a threat to security, especially in poor and conflict-ridden countries. Crime is fueling

89. United Nations Office for Outer Space Affairs, *United Nations Treaties and Principles on Outer Space, Related General Assembly Resolutions and Other Documents,* 2015), 62-68.
90. As mentioned in Chapter 2, the U.S. legalized asteroid mining, but the determination has not yet withstood international scrutiny. Removal of legal prohibitions against resource appropriation is, to scholars such as Dolman and Ziarnick, the key to enticing commercial exploitation of space.
91. United Nations Office on Drugs and Crime, *The Globalization of Crime: A Transnational Organized Crime Threat Assessment,* 2010), ii-vi.

> corruption, infiltrating business and politics, and hindering development. And it is undermining governance by empowering those who operate outside the law.[92]

A space police, therefore, may be needed to protect American, and even international citizens, from nefarious space actors. Finally, a space police could perform rescue functions, although, current operational realities do not merit such a role.[93]

From the Realist school of thought, using USAF astronauts as a policing force would constitute a "high-ground light" version of Dolman's *Astropolitik*. While not overtly meant to seize the high ground, the force could ostensibly be transformed for such a mission if the need arose. For reasons already stated, however, using astronauts to seize the high-ground may prove unfruitful. Instead, are there other Realist theoretical reasons for an astronaut police force?

Everett Dolman has often received vitriol for his geopolitical recommendations in *Astropolitik*; however, the writing's purpose was "to place a more stringent conceptual framework around and among the many vectors of space policies and chronicles."[94] More recently, he explicated his apparently extreme position as a method to engender discussion and force recognition of the United States' waning advantage in space.[95] At its core, Dolman's theory is a Mahanian model extrapolated for space.[96] To Dolman, spacepower begets economic opportunity and national power. It is for economic opportunity that the United States should expand in space.

Brent Ziarnick shares a similar assessment of space's economic possibilities in his *Developing National Power in Space: A Theoretical Model*. Ziarnick, a self-proclaimed Mahanian, builds upon James Holmes and Toshi Yoshihara's interpretation of Mahan's theory, and Joseph Schumpeter's economic theory to develop his general spacepower theory.[97] For Ziarnick,

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92. United Nations Office on Drugs and Crime, *The Globalization of Crime: A Transnational Organized Crime Threat Assessment,* ii.
93. See Chapter 2.
94. Dolman, *Astropolitik: Classical Geopolitics in the Space Age,* 2.
95. Dolman, "Astropolitik: A Case for Weapons in Space" (Lecture, School of Advanced Air and Space Studies, Maxwell AFB, AL, 7 March 2016).
96. Dolman, *Astropolitik: Classical Geopolitics in the Space Age,* 32-50.
97. Brent Ziarnick, *Developing National Power in Space: A Theoretical Model,* (Jefferson

"space power is simply the ability to do something in space," and is manifest through the Grammar Delta, or "how space power is built and conducted by individual units."[98] The Grammar of spacepower gives access.[99] Each discrete form of access is integrated to give a nation ability in space, which is the apex of Ziarnick's Logic Delta.[100] "The Logic of Space Power is a sibling to that of sea power. Spacepower's ultimate purpose is to generate wealth from space activities, and commerce is the true path to national greatness in space."[101] Taken together, the Grammar and Logic Deltas are not separable and, in fact, inform one another.[102]

Ultimately, the goal of the spacefaring nation is to aggregate more power, which is a classical Realist goal. Once a nation has spacepower, that "spacepower must be applied in the economic, political and military sphere."[103] In other words, spacepower begets national power because spacepower enhances an "entity's economic, military, and political power."[104] Despite Ziarnick's consideration of military and political power, his theory is, at its core, an economic theory for space. Production, "generates wealth from space and is the backbone of economic space power."[105] Moreover, spacepower "is primarily economic power."[106]

If Ziarnick's claims are true, then who will protect the merchants who dare to go boldly into the abyss of space? A *laissez-faire* attitude suggests Adam Smith's "invisible hand" can guide economic development for the

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City, NC: McFarland, 2015), 3, 39-61. This paper highlights Ziarnick's synchronicity with Mahanian principles because, in comparing Ziarnick's theory with Sir Julian Corbett's and Admiral A.T. Mahan, this author detects more similarities between Corbettian thought and Ziarnick's theory. Most students of strategy designate Mahan's theory as a theory on naval power whereas Corbett's broadens to include land as well, hence the maritime designation. The reader is encouraged to investigate and discern for him or herself. See Julian Corbett, *Some Principles of Maritime Strategy,* (Annapolis, MD: Naval Institute Press, 1988), 352; Alfred T. Mahan, *The Influence of Sea Power Upon History, 1660-1783,* 5th ed. (Mineola, NY: Dover Publications, 1987), 640.

98. Ziarnick, *Developing National Space Power,* 13.
99. Ziarnick, *Developing National Space Power,* 16-23.
100. Ziarnick, *Developing National Space Power,* 25, 32.
101. Ziarnick, *Developing National Space Power,* 25.
102. Ziarnick, *Developing National Space Power,* 33.
103. Ziarnick, *Developing National Space Power,* 32.
104. Ziarnick, *Developing National Space Power,* 25.
105. Ziarnick, *Developing National Space Power,* 16-17.
106. Ziarnick, *Developing National Space Power,* 28, 43.

betterment of humanity. Yet, Garrett Hardin, in "The Tragedy of the Commons," suggests such a *laissez-faire* approach cannot work. Someone must be the arbiter of justice in the global commons of space. To wit, Dolman suggests that the "tragedy of the commons" does not have to occur.[107] A benevolent hegemon could police space, thereby avoiding Hardin's solution of protecting the commons through restricting individual freedoms.[108] USAF astronauts could enforce space commerce laws and ensure no "economic competitor [would] be prohibited from attempting to gain access to the market," or to maintain access once it was gained, acting as the "shepherd" (or perhaps watchdog) for the international community.[109] In effect, the Airmen astronaut could act as one part of the "discriminating monopolist" of power who helps stabilize the free market and "permit[s] unfettered, productive economic competition."[110]

Dolman is not alone in suggesting such uses of United States' spacepower. Scott Pace, in *Towards a Theory of Spacepower*, examines similar roles for a spacepower with his "Guardian and Merchants" paradigm.

> The term Guardians comes from Plato's *The Republic*. It includes members of the political class who are responsible for governing and teaching. In space policy, one finds many examples of Guardians, good and bad, among career civil servants, military officers, political appointees, congressional staff, journalists, academics, and even the occasional corporate officer and professional politician. The term Merchants refers to the group of people whose culture encourages energy and risk-taking. Although examples are mostly found in business and to a lesser extent in international science, they sometimes are represented in government, the military, and academia.[111]

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107. Dolman, *Astropolitik: Classical Geopolitics in the Space Age,* 101-105. Garrett Hardin's "The Tragedy of the Commons" explains how administration of the commons may be necessary to preserve the commons, instead of a *laissez-faire* approach. See Garrett Hardin, "The Tragedy of the Commons," *Science* (13 December 1968): 1243.
108. Hardin, "The Tragedy of the Commons," 1248; Dolman, *Astropolitik: Classical Geopolitics in the Space Age,* 104, 177.
109. Dolman, *Astropolitik: Classical Geopolitics in the Space Age,* 157, 177.
110. Dolman, *Astropolitik: Classical Geopolitics in the Space Age,* 177.
111. Scott Pace, "Merchant and Guardian Challenges in the Exercise of Spacepower," in *Towards a Theory of Spacepower*, ed. Peter L Hays, and Charles D Lutes (Washington, DC: National Defense University Press, 2007), 133.

In justifying the Guardian, Pace explains that for "the 'invisible hand' of Adam Smith's market economy to function, a predictable, supportive environment must exist to create wealth."[112] In other words, the government must play the role of the "hidden (or sometimes overt) fist" to preserve order and the rule of law.[113] The space merchants require the presence of space guardians to ensure their prosperity. Pace agrees with the assessment in chapter 2 of this work: "the commercial space sector is continuing to grow and diversify."[114] For him, spacepower is shaped and defined by the interplay of national security and commercial objectives.[115] The two sectors must work synergistically to optimize a nation's spacepower. Pace's ideas suggest that if the USAF were to establish an astronaut corps, using that force as a space police could provide the necessary buttress for further economic, and hence national, power development. Ziarnick also identifies the need to protect commerce in space, as well as other guardian services, with his ideas on a Space Guard.[116]

Imagining how such a police force would look is beyond the scope of this thesis, but it is interesting to note that the Realist camp generally accepts the idea of a space police force.[117] This acceptance comes from the fact that space police, in theory, will enable broad, economic development in space. Space economic development, in turn, satisfies the self-interest of the United States. Such a linkage of cause and effect is a classic "flag follows trade" phenomenon.[118] Nations follow the merchants both to enrich their populations and to protect the new wealth. An astronaut corps that helps protect merchants and property alike accords with Realist theories of spacepower. Does such a concept, however, comport with Liberal tenets?

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112. Pace, "Merchant and Guardian Challenges in the Exercise of Spacepower," 133.
113. Pace, "Merchant and Guardian Challenges in the Exercise of Spacepower," 133.
114. Pace, "Merchant and Guardian Challenges in the Exercise of Spacepower," 150.
115. Pace, "Merchant and Guardian Challenges in the Exercise of Spacepower," 128.
116. Ziarnick, *Developing National Space Power,* 131, 143, 152-155.
117. See Klein, *Space Warfare: Strategy, Principles and Policy,* 111-126, 141-151. for another Realist perspective on spacepower and the ideas that can be extrapolated to support the concept of a USAF astronaut police force.
118. Hays, *United States Military Space: Into the Twenty-First Century,* 10, 31; Hays, *Space and Security: A Reference Handbook,* 64.

Interestingly, there appears to be little opposition to such a concept. While no authors explicitly address the idea of space guardians, their thoughts lead a reasonable strategist to consider such an entity. For example, Johnson-Freese states that the United States "must solidify its position of strength by codifying the status quo" through a series of confidence-building measures and clear delineation of the "parameters for acceptable space activity." Moreover, she explains that "all nations will seek and expect full utilization privileges" of space.[119] A space police force could ensure that such expectations are realized and ensure the "rules of the road" are followed.[120] One of Johnson-Freese's disciples admitted that policing action in space makes sense, provided the United States invites others to the effort.[121]

Finally, James Moltz wrote, "viewing space security from the perspective of self-interested actors seeking to protect their access to space in a gradually constricting collective good environment may offer advantages over tying space security debates to nuclear and other 'hard' security issues."[122] In other words, while addressing the current discussion about anti-satellite technology and space weapons, Moltz suggests that it is more productive to speak of collective security and protective measures, and work to build norms in space rather than rely upon unilateral military efforts. While social interactionist approaches can work to raise collective space security, the process of interaction is highly reliant upon the "complexion" of leaderships within the international space community.[123] "Perhaps global institutionalism policies might be necessary to create more permanent change in space security relations."[124]

The question, then, becomes, what mechanism will be required to ensure all spacefaring entities abide by these policies? Moltz asks a similar question in rebuttal to Charles Peña's recommendation for a *laissez-faire* approach. "Who will play the role of enforcer?" asks Moltz.[125] This work suggests an astronaut police force as a plausible solution. If space is to be viewed "as a resource to be

119. Johnson-Freese, *Space as a Strategic Asset,* 234.
120. Johnson-Freese, *Space as a Strategic Asset,* 246-247.
121. Dittmer, ""Space as a Strategic Asset"" (Lecture, School of Advanced Air and Space Studies, Maxwell AFB, AL, 11 March 2016).
122. Moltz, *Politics of Space Security,* 40.
123. Moltz, *Politics of Space Security,* 324.
124. Moltz, *Politics of Space Security,* 325.
125. Moltz, *Politics of Space Security,* 345.

preserved for use by all rather than as a territory to be seized and protected," who will preserve it once commercial enterprise makes space a brave new world? Moreover, who will bear the enforcement costs?[126] The United States, according to Moltz, may not have the moral superiority of Dolman's theory, but could use its moral leadership to sell the idea of a policing force to the international community.[127]

Human spaceflight and astronauts already wield considerable amounts of soft power. This soft power may be the most effective tool for cooling the burgeoning security dilemma between the United States and China.[128] For Johnson-Freese, "the United States needs to again recognize and embrace the leadership opportunity offered by manned space exploration."[129] The same may prove true for space policing actions that preserve the sanctity of the commons for all spacefarers. The concept, at the very least, merits contemplation. Conditions have evolved and will continue evolving rapidly such that the need for a space enforcement mechanism in not only plausible but probable. The student of strategy cannot ignore the plausible simply because context today relegates such ideas to the bin of seemingly fantastic imaginations.

The student of strategy not only must address the plausible, he or she must also consider the unintended consequences of deploying a space police force. Just as in the previous section regarding manned weapon systems, the idea of military astronauts as space police may encounter resistance. While a space police force is less overtly militaristic, perception is in the eye of the beholder. A space police force could conceivably threaten the security of other nations and engender a security dilemma. If the United States deemed developing a space police force necessary for grand strategy, then it should also make efforts to assuage security concerns within the spacefaring community. Transparency and confidence-building measures are a start. By hosting an open dialogue on the need for space police and allowing interested parties to participate in the discussion, the United States can decrease other nation's uncertainty about the veracity of its intentions.

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126. Moltz, *Politics of Space Security,* 347-348.
127. Moltz, *Politics of Space Security,* 347.
128. Johnson-Freese, *Space as a Strategic Asset,* 25, 80, 81.
129. Johnson-Freese, *Space as a Strategic Asset,* 248.

Confidence-building measures, however, can be overvalued.[130] The United States could admix confidence-building measures with strong moral leadership while it established a space police force. Inviting other spacefarers in as partners, and not just participants, while also agreeing to limitations on how nations employ a space police, would benefit the United States.[131] Doing so would exemplify G. John Ikenberry's concept of strategic restraint thereby strengthening the United States' legitimacy and adding credibility to the nation's position atop the international space order.[132]

Along the lines of emphasizing moral leadership and cooperation, Nancy Gallagher offers her "Space Governance for Global Security Logic."[133] To her, the United States should emphasize:

> The premise that all current and future space users share the same strategic objectives attributed to the United States: to secure the space domain for peaceful use; to protect space assets from all hazards; and to derive maximum value from space for security, economic, civil, and environmental ends. If the goal of space cooperation is to maximize all participants' interests in these shared objectives, then the benefits of cooperation become much larger and more compelling than in the other two logics.[134]

These other two logics are the strategies of "informal management of the commons" and "cooperation around the fringes" which just barely enhance strategic stability as she explains.[135]

> Modern space operations are much more expensive and technologically challenging than grazing cattle, and the diversity of interests and capabilities among space users is much greater than among the villagers sharing Hardin's commons. Therefore, space cooperation should have the positive objective of organizing space users to work together and accomplish more for less than they could on their own, not just the negative objectives of minimizing

130. Nancy Gallagher, "Space Governance and International Cooperation," *Astropolitics* 8, (December 2010): 267.
131. Johnson-Freese, *Space as a Strategic Asset,* 252.
132. G. John Ikenberry, *Liberal Leviathan: The Origins, Crisis, and Transformation of the American World Order,* (Princeton, NJ: Princeton University Press, 2012), 105-109.
133. Gallagher, "Space Governance and International Cooperation," 271.
134. Gallagher, "Space Governance and International Cooperation," 271.
135. Gallagher, "Space Governance and International Cooperation," 263-264.

> inadvertent interference, environmental degradation, or deliberate attack.[136]

A space policing effort, led by the United States and partnered with other spacefaring nations, may prove the only panacea for ailments of an increasingly congested and contested space environment.

Conclusion

The adverse consequences resulting from the pursuit of a manned, space weapon system seem to outweigh the benefits. Certainly, that assertion seems valid from a theoretical standpoint. Tarnished international standing, loss of moral high-ground, and most importantly, security dilemmas resulting from using astronauts to operate space weapons, loom large when analyzed with Liberal theory. Even if global conditions change and the above consequences no longer exist, the time may have well passed for using military members to seize and weaponize space.[137] Still, there may come a time that the nation will require space soldiers, but that time is not now. Furthermore, that time may never arrive. Indeed, theory illuminates several consequences of weaponizing space with astronauts that could pose as a countervailing force well into the future.

On the other hand, theory and international conditions suggest the validity of using astronauts to police space. The Realist school, largely driven by economic progress and nationalist sentiment, indicates that someone will need to regulate space and protect extraterrestrial commerce. Liberal thought, on the other hand, trends more towards collective action and global institutionalism, yet this school also allows for space regulation. The main difference is in the implementation. Realist theory gives little credence to anything beyond self-interest, and Liberal theory recommends an approach that secures international buy-in. If commercial space development proves all that

136. Gallagher, "Space Governance and International Cooperation," 271.
137. Dolman, "Astropolitik: A Case for Weapons in Space" (Lecture, School of Advanced Air and Space Studies, Maxwell AFB, AL, 7 March 2016). Dolman in his lecture stated that the time to enact an *Astropolitik* strategy was before China demonstrated the ability to contest space with kinetic capabilities of its own. Now, it is likely that any attempt to seize low-Earth orbit would be challenged directly.

it promises, a shepherd will be needed, and as Dolman recognized, one has to be in the environment to influence and protect it.[138] Airmen can be space's guardians.

This chapter ends with the following quote from Johnson-Freese. The quote best summarizes the potential benefit of an astronaut police force to the United States and its partners. "For the space ambitions of the United States to prevail without an unintended and counterproductive clash with other countries, the connectivity between activities in the manned, military, and commercial arenas must be not only recognized but considered and factored into decision making."[139] Accordingly, the time has come to consider the military person's role in space, especially in the role of space police. To that end, the next chapter will examine case studies on astronaut selection and offer recommendations for future astronaut corps construction as it relates to that role.

138. Dolman, "Astropolitik: A Case for Weapons in Space" (Lecture, School of Advanced Air and Space Studies, Maxwell AFB, AL, 7 March 2016).
139. Johnson-Freese, *Space as a Strategic Asset,* 257.

Chapter 4

Building an Air Force Astronaut Corps: Insights from Project Mercury and Modern NASA Astronauts

What kind of people volunteer to be fired into orbit? One might expect strong intimations of psychopathology…we were surprised there was no evidence for a diagnosis of psychosis, clinically significant neurosis, or personality disorder in any member of this group.

George Ruff

Introduction

This work has thus far laid out a portion of the strategic environmental and theory-based factors influencing the case for an Air Force astronaut corps. While the exogenous influences are myriad, and any prognostication is inherently inaccurate vis-a-vis retrospection, previous sections highlighted an area where USAF astronauts may be needed. The current strategic environment and predictions for the future suggest (but may not require) building a space-based police force. USAF astronauts could fulfill such a role. Moreover, the theory-based observations and implications of chapter 3 redoubled the plausibility of such an idea.

The author mentions these ideas simply to establish the rationale behind this chapter. This chapter will explore two historical case studies involving astronauts from two eras: Project Mercury and modern NASA astronauts. As stated in the first chapter, the sample size is small and does not account for all potential factors relevant to the success of a person's selection and performance as an astronaut.[1] Indeed, limiting the sample size should allow the author to deduce patterns and characteristics that resulted in an individual's selection for astronaut duty without having to account for problems of collinearity between independent variables (the two astronaut groups). Additionally, given that the USAF has never had an astronaut corps, there may be some instructive

1. Note that there have only been 330 NASA astronauts in history before the last class selected in 2013. See National Aeronautics and Space Administration, *Astronaut Fact Book,* (Washington, DC: NASA, April 2013), 5-3. With the latest class, the number was to 338. Therefore, the author acknowledges the high likelihood of having large margins of error caused by taking small sample sizes of a small population. See "Estimating a Proportion for a Small, Finite Population," Penn State, 2016, Accessed 24 March 2016, https://onlinecourses.science.psu.edu/stat414/node/264.

observations from the ground-breaking Mercury astronauts. Alternatively, using modern astronauts as the other end of the sample spectrum offers a contemporary comparison. NASA's recent experience with long-duration missions and plans for deep-space exploration are relevant to the role of space police should the USAF decide to create an astronaut force.

The reader should note that this work does not proffer the definitive analysis of astronaut selection. While the astronaut population from which to draw samples is small, the writing on America's astronauts (the first especially) is expansive.[2] This chapter merely performs a general investigation of this early group and the current crop of astronauts.

Ultimately, by analyzing these two groups, the author hopes to draw out generalizable qualities that could prove useful in building a USAF astronaut corps. Certainly, there are similarities in characteristics among the Project Mercury and modern-day astronauts. Nevertheless, the author will highlight the fact that NASA specifically sought test pilots as its first astronauts because of the skills and qualities required in test piloting. Furthermore, the Mercury astronauts displayed adept problem-solving skills, and they embodied the spirit of pioneers. Modern-day astronauts also exhibit many of the skills and qualities of America's first astronauts. The author, however, will emphasize how teamwork skills and personal adaptability are increasingly essential for the missions NASA performs today and will perform in the future. This chapter will conclude by analyzing how these five characteristics would be important for a future USAF astronaut corps, especially in the role of space police.[3]

2. The reader is encouraged to visit "Researching NASA History," NASA.gov, 14 July 2015, Accessed 24 March 2016, http://history.nasa.gov/refcoll.html. There is less publicly available data on current astronauts due to privacy and security reasons. The author relied on personal interviews as well as astronaut biographies and technical reports regarding astronaut selection found at "Astronauts," NASA.gov, 29 October 2015, Accessed 24 March 2016, http://www.jsc.nasa.gov/Bios/astrobio.html. ; "NASA Technical Reports Server (Ntrs) - Basic Search," NASA.gov, 24 March 2016, Accessed 24 March 2016, http://ntrs.nasa.gov/.

3. Based on the analysis in Chapters 2 and 3, the author deems the space police role as the most likely for USAF astronauts.

> Indeed, one of the most fascinating aspects of Project Mercury has been the sociology of the astronauts themselves. What kind of man could manage to be part pilot, part engineer, part explorer, part scientist, part guinea pig—and part hero—and do equal justice to each of the diverse and demanding roles that was thrust upon him?
>
> What kind of man, above all, would be best qualified to help set the rare standards of courage and stamina, skill and alertness, vision and intelligence that would be needed to lead him and his colleagues to the moon and to Mars and to distant places beyond?
>
> The National Aeronautics and Space Administration (NASA) was pondering these same questions in the fall of 1958 when it first began to lay the groundwork for its man-in-space program and had to decide, among many other pressing problems, exactly what kind of human being it needed to man the cockpit.[4]

Project Mercury's groundwork began with NASA determining the type of mettle a prospective astronaut should possess. Yet, finding the types of people who possessed a blend of technical and physical acumen along with an ability to relate to the public was no easy task. NASA thought one who met certain basic requirements would possess the qualities the agency sought. "The general requirements were: possession of a bachelor's degree or equivalent in engineering or the physical sciences; graduation from a military test pilot school; 1,500 hours of jet flying time; under age 40; and 5 feet 11 inches in height or less. The educational requirement was set because of the variety of scientific and technical problems that would confront the astronauts throughout the program."[5]

None of NASA's requirements, however, directly addressed the intangible qualities that *Time Magazine's* John Dille outlined in the previous epigraph. To assess an individual for those characteristics, NASA employed a joint team of Air Force, Army, and Navy medical experts to evaluate potential astronaut candidates at Wright Air Development Center Aeromedical Laboratories.[6]

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4. John Dille quoted in M. Scott Carpenter*, et al.*, *We Seven: by the Astronauts Themselves,* (New York, NY: Simon and Schuster, 1962), 6.
5. Senate, *Project Mercury: Man-in-Space Program of the National Aeronautics and Space Administration,* 86th Congress, 1st sess., 1 December 1959, 46.
6. Senate, *Project Mercury: Man-in-Space Program,* 41-42.

Despite this charge, Matthew Hersch writes in *Inventing the American Astronaut* that "NASA psychiatrists never felt entirely comfortable with their role in selecting the first astronauts," with some believing that their only role was to screen for mental illness and cull out those applicants who failed such screens.[7] This medical team, along with the Charles Donlan led astronaut selection board, began the task of winnowing from the hundreds, seven men who demonstrated a "willingness to be hurled into space."[8] What Donlan and his team recorded and learned can be instructive to the USAF should it decide to build a modern-day astronaut corps. Namely, in investigating Project Mercury astronaut selection, this work intends to highlight three characteristics of the Mercury Seven that the USAF should consider for any future astronaut corps. These qualities or characteristics were: each Mercury astronaut was a test pilot; each possessed a unique desire and ability to solve intricate problems; and each embodied an endeavoring spirit as measured by their willingness to sacrifice proven career paths for the unknowns of spaceflight. The Mercury Seven's qualities, taken together, imbued them with the "right stuff" to help the United States stand back up after Sputnik's blow to American prestige.[9]

Why Test Pilots?

Why did NASA choose to narrow the field of potential astronauts to just military test pilots?[10] Rather surprisingly, NASA's original call for applicants

7. Matthew H. Hersch, *Inventing the American Astronaut*, (New York, NY: Palgrave Macmillan, 2012), 25.
8. Hersch, *Inventing,* 1, 25; Charles Donlan (NASA Deputy Associate Administrator for Manned Space Flight), Interview by Jim Slade, 27 April 1998, Transcript, Washington, DC, 12-13.
9. Tom Wolfe, *The Right Stuff,* Revised ed. (New York, NY: Picador, 1979), 18.
10. The reader is encouraged to see House, *Qualifications for Astronauts: Hearings Before the Special Subcommittee on the Selection of Astronauts of the Committee on Science and Astronautics,* 87th Cong., 2nd sess., 17-18 July 1962, This hearing of the Special Subcommittee for the Selection of Astronauts explored the processes by which NASA selected its first astronauts. Interestingly, at least to Congressional testimony, NASA did not intend to exclude women from applying. President Eisenhower's decree (see Charles Donlan's 1998 interview with Jim Slade) that the first astronauts be military astronauts, by default, excluded women. The qualifications of the Mercury 13 were and still are remarkable as explained in recorded testimony from the aforementioned Congressional hearing.

had no explicit requirement for an applicant to be a military test pilot.[11] NASA simply wanted applicants to "have had a substantial and significant amount of experience which has clearly demonstrated three required characteristics:

> (a) willingness to accept hazards comparable to those encountered in modern research airplane flights
>
> (b) capacity to tolerate rigorous and severe environmental conditions
>
> (c) ability to react adequately under conditions of stress or emergency.[12]

NASA suggested that test piloting, among other careers, fit the bill and adequately demonstrated a candidate's ability to handle stress.[13] Despite the array of qualifying "hazardous, rigorous, and stressful experiences," Matthew Hersch writes that NASA quickly retracted the apparent all-call for astronauts because it decided that narrowing the pool solely to military test pilots enabled NASA to avoid normal civil service hiring procedures.[14] Doing so also shrank the pool from millions of potential applicants that "the man-on-the-street plan" would likely bring, to a little over 500 when considering only military test pilots.[15] Moreover, "military pilots could be contacted and interviewed more quickly than any other group," and there was the added benefit that "NASA might not even need to pay them" since the military already paid them.[16]

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11. "Invitation to Apply as Research-Astronaut Candidate," *NASA.gov,* Accessed 28 March 2016, http://history.nasa.gov/40thmerc7/invite.pdf, 3-4.
12. "Invitation to Apply as Research-Astronaut Candidate," 4.
13. "Invitation to Apply as Research-Astronaut Candidate," 4.
14. Hersch, *Inventing,* 14; "Invitation to Apply as Research-Astronaut Candidate," 4.
15. Stanley White (Medical Researcher with Project Mercury), Interview by unknown, 18 July 1965, Transcript, San Antonio, TX, 3-4; Loyd S. Swenson, James M. Grimwood, and Charles C. Alexander, *This New Ocean: A History of Project Mercury,* (Washington, DC: NASA, 1966), 160; Dr. Robert B. Voas (Department of Transportation psychologist and Former NACA and NASA psychologist), Interview by Bob Sherrod, 12 January 1970, Transcript, Washington, DC, 1.
16. Hersch, *Inventing,* 15. Joseph Bell in *Seven into Space*, echoes these ideas. By contrast, military test pilots offered a number of peculiar advantages. They were available. (The military services had indicated willingness to cooperate with the man-into-space program.) They would suffer no financial loss. (If military pilots were selected, they were to be paid at their military pay rate.) They were adjusted to the rigors of military life. And their complete records were easily accessible to NASA authorities." Joseph N. Bell, *Seven Into Space: The Story of the Mercury Astronauts,* 1st ed. (New York, NY: Popular Mechanics Co., 1960), 53-55.

NASA's spokesman, Walter Bonney, corroborated such a pragmatic arbitrariness.[17] Finally, President Eisenhower favored using military test pilots because by "keeping it in the family," the nation could rely on the test pilots' obligation to assist the country in its space race against the Soviet Union.[18]

None of the justifications, however, made the military test pilot unique but were merely pragmatic reasons for selecting test pilots. What made test pilots unique, however, was their numerous intangibles that would prove highly useful to the United States. As Charles Donlan stated, putting a human into space for the first time was a monumental event. It was a "pioneering venture."[19] NASA needed would-be astronauts with experience, to borrow a cliché, living on the cutting-edge. Test pilots provided NASA with such experience.

Test pilots, however, possessed more than the pioneering experience of being the first to break barriers. Test pilots also brought with them the type of flying experience that was postulated to carry over into spaceflight. Specifically, "many of the conditions expected in orbital flight were similar to those experienced by military test pilots."[20] During the period of Mercury's astronaut selection, test pilots flew the first aircraft into space with the X-15 program.[21] According to Michelle Evans, "The pilots of these rocket planes were a special breed."[22] Furthermore, "The difficulties presented by winged flight out of the atmosphere in the X-15 are, in many ways, a more significant achievement than the brute force of launching a spacecraft into orbit on the top of a large tubular

17. "Press Conference of Mercury Astronaut Team," *NASA.gov,* Accessed 28 March 2016, http://history.nasa.gov/40thmerc7/presscon.pdf, 15.
18. Hersch, *Inventing,* 15; Charles Donlan and Chris Kraft (Both men were involved with NASA astronaut selection), Interview by Robert Sherrod, 15 January 1970, Transcript, Washington, DC, ; Donlan, Interview by Jim Slade, 18; Swenson, Grimwood, and Alexander, *This New Ocean: A History of Project Mercury,* 131.
19. Donlan, Interview by Jim Slade, 19.
20. House, *Report of the Special Subcommittee on the Selection of Astronauts,* 87th Cong., 2nd sess., 1962, 1.
21. Michelle L. Evans, *The X-15 Rocket Plane: Flying the First Wings into Space,* (Lincoln, NE: University of Nebraska Press, 2013), The reader should note that none of the X-15 pilots involved in these firsts out at Edwards AFB were selected into Project Mercury, however, Joe Engle and Neil Armstrong each became NASA astronauts in following selection groups. Neil Armstrong turned down an interview to focus on what he believed was important work with the X-15. See as well Donlan, Interview by Jim Slade,
22. Evans, *The X-15 Rocket Plane: Flying the First Wings into Space,* 425.

stack of metal and fuel." While Evans spoke specifically of the X-15, other experimental aircraft of the day required equivalent flying acumen.[23]

Still, flying acumen and familiarity with an environment believed to be similar to space were just some reasons NASA sought test pilots. Test pilots were also thought to have a keener ability to make the *correct* decisions with rapidity, even when under palpable stress. Flight testing required such decision-making skills, and NASA believed spaceflight would demand the same. George Ruff, one of the psychiatric evaluators during Mercury's astronaut selection, echoed the importance of being able to make quick and correct decisions while under duress.

> The pilot should be able to function when out of familiar surroundings and when usual patterns of behavior are impossible. He must show evidence of ability to respond predictably to foreseeable situations, without losing the capacity to adapt flexibly to circumstances which cannot be foreseen. He should not demonstrate evidence of impulsivity. He must act when action is appropriate, but refrain from action when inactivity is appropriate. He must be able to tolerate stressful situations passively without requiring motor activity to dissipate anxiety.[24]

On his "Mercury orbital flight," John Glenn demonstrated this ability to repress anxiety and make correct decisions despite a realistic chance any mistake might result in his death.[25] During the flight, mission controllers received an indication that Glenn's heat shield had liberated, which could have led to vehicle disintegration upon encountering the extreme heat associated with atmospheric reentry. Controllers relayed the fault to Glenn who despite

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23. Evans, *The X-15 Rocket Plane: Flying the First Wings into Space,* 226. See also Carpenter*, et al.*, *We Seven,* 71. In this book, Deke Slayton explains that the "experienced test pilot is trained to run into things that no one has yet written a book about. He never knows what the devil is going to happen. He just has to be prepared to cope with it. It is this native ability to realize when you are in trouble and to what degree you are in trouble that really counts….you can really get yourself into trouble very fast simply by doing the wrong thing first."
24. George Ruff's report in Wright Air Development Center, *Project Mercury Candidate Evaluation Program,* Edited by Charles L. Wilson, ed., (Washington, DC: Defense Technical Information Center, 1959), 81.
25. Richard P. Hallion, *Test Pilots: The Frontiersmen of Flight,* Revised ed. (Washington, DC: Smithsonian Institution Scholarly Press, 1988), 262; John H. Glenn (Former NASA astronaut), Oral History interview by Sheree Scarborough, 25 August 1997, Houston, TX, 16.

the pressure, "piloted the craft on a precise and uneventful reentry."[26] Glenn's ability to "react quickly and coolly in a difficult situation," coupled with his preparation to face an environment "in which the failure of a simple component in the system *could* mean disastrous results for both the mission and the crew," was instrumental.[27]

Glenn's fellow astronaut, Walter Schirra, echoed the sentiment that years of test piloting experience were invaluable to NASA. To Schirra, training and expertise as test pilots had steeled the nerves and strengthened the decision-making skills of the first astronauts. "I felt that l had the experience and qualifications for the job. I knew there were unknown dangers involved and that the Astronauts would be using a brand-new kind of flight system. But I was certain that my years of combat flying and test piloting had prepared me to handle any kind of emergency."[28] In other words, NASA sought test pilots because "all jet test pilots were selected and trained to make rapid decisions and take immediate action based upon their own evaluation of the situation in the presence of high personal risk."[29]

Glenn and Schirra demonstrated why the test pilot, well-adapted to unfamiliarity, and accustomed to handling unusual exigencies, was thought ideal for the novelty of spaceflight.[30] Jerrie Cobb, an enormously accomplished pilot and a member of the Mercury 13, however, believed that the test pilot community did not monopolize those qualities.[31] During hearings before the

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26. Hallion, *Test Pilots: The Frontiersmen of Flight,* 262.
27. Carpenter*, et al.*, *We Seven,* 32, 158. Interestingly, the indication that mission control received ended up being a false one, but this fact was not known during the mission. Nevertheless, Glenn's ability to compartmentalize and not allow a potential emergency to rattle him certainly aided his safe recovery. See Hallion, *Test Pilots: The Frontiersmen of Flight,* 262.
28. Carpenter*, et al.*, *We Seven,* 60.
29. George Low, NASA Director of Spacecraft and Flight Missions in Congressional testimony. See House, "Qualifications for Astronauts," 45.
30. National Aeronautics and Space Administration, *Project Mercury Summary Including Results of the Fourth Manned Orbital Flight,* (Washington, DC: US Government Printing Office, October 1963), 171. Interestingly, NASA determined that the stress tests (physical and psychological) used in Project Mercury corroborated what they suspected. Test pilots, by their profession, were already thoroughly stress-tested. Accordingly, NASA cut initial stress testing for Project Gemini candidates. See National Aeronautics and Space Administration, *Project Mercury Summary,* 200.
31. The Mercury 13 was composed of the women evaluated for potential astronaut duty by Dr. Randolph Lovelace. See Martha Ackmann, *The Mercury 13: The True Story of Thirteen Women and the Dream of Space Flight,* Reprint ed. (New York, NY: Random

Special Subcommittee on the Selection of Astronauts of the Committee on Science and Astronautics, she stated that "what counts is flawless judgment, fast reaction, and the ability to transmit that to the proper control of the craft" during her explanation for why women should also be astronauts.[32] While NASA's requirements for military test pilots, unfortunately, ruled out women by default, her testimony revealed why NASA targeted test pilots for astronaut duty.[33] George Low, NASA's Director of Spacecraft and Flight Missions, summarized why test pilots were uniquely qualified to perform as America's pioneers in space.

> Careful examination and evaluation of the tasks that an astronaut must perform, and the emergency situations with which he must be prepared to cope, have led to the conclusion that, of all existing occupations, the testing of jet aircraft most nearly approximates the piloting of spacecraft. All jet test pilots are selected and trained to make rapid decisions and take immediate action based upon their own evaluation of the situation in the presence of high personal risk. In many ways, manned spacecraft can be considered as a next generation very high performance jet aircraft. Their velocity and altitude capabilities are very great.
>
> Thus, there is a logical reason for selecting jet test pilots—for the piloting of spacecraft. In order to limit the selection to those applicants who have demonstrated their capabilities, the further qualification that the applicants be experienced jet test pilots was established.[34]

Test pilots, by training and craft, were adept at handling novel, technical systems and could do so even while under considerable duress. NASA deemed the ability to handle stress, among other psychological factors, to be of primary importance in selection. Logic demanded that NASA favor the group of professionals steeped in this highly valued quality.[35] Test pilots were not the

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House Trade Paperbacks, 2004), 280; House, "Qualifications for Astronauts," ; House, *Subcommittee on the Selection of Astronauts,*

32. House, "Qualifications for Astronauts," 13.

33. Women were not allowed to fly in the military. Moreover, since the only test pilot schools at the time were administered by the military, women had no method of becoming jet test pilots. Thus, they could not apply to NASA. See House, "Qualifications for Astronauts," 56.

34. House, *Subcommittee on the Selection of Astronauts,* 7.

35. Wright Air Development Center, *Project Mercury Candidate Evaluation Program,* 99. Famed aviator, Jacqueline Cochran, believed that the sheer expense of sending humans

sole proprietors of such qualities, but in test pilots, NASA knew it had potential astronauts suffused with characteristics deemed vital for helping the fledgling agency gain its space wings and learn to fly.

Problem Solving

The Mercury astronauts were more than test pilots. They were problem-solvers. Such a distinction seems superfluous given the nature of test piloting. Indeed, part of what reinforced the idea of the steely-eyed test pilot was their demonstrated ability to identify and fix inflight problems despite enduring considerable stress. These abilities enhanced the myth of the daredevil test pilot. Of the 69 finalists for Mercury, however, "very few fit the popular concept of the daredevil test pilot."[36] Still, the ability to solve problems was not, and is not, the sole territory of the test pilot. Hence, this work makes the distinction between the quality of being a test pilot and the quality of being a keen problem-solver, as the latter quality bore equal importance for NASA in selecting its Mercury astronauts, and could bear importance in choosing USAF astronauts of the future.

The need for problem-solving skills was the main impetus behind NASA's requirement that its astronauts possess a technical degree.[37] Such a requirement, consequently, eliminated renowned test pilots like Chuck Yeager.[38] Admittedly, there was a debate on the validity of requiring a technical degree, but NASA agreed that "accidents [could] be avoided by knowledge and caution…that risks [were] minimized by thorough planning and conservatism."[39] Problem-solving abilities coupled with technical know-how were paramount.

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to space meant that the nation could ill-afford not to select from top one percent of aviators. See House, "Qualifications for Astronauts," 23-24.
36. Senate, *Project Mercury: Man-in-Space Program,* 67; Voas, Interview by Bob Sherrod, 2.
37. Senate, *Project Mercury: Man-in-Space Program,* 46; House, "Qualifications for Astronauts," 45-46.
38. House, "Qualifications for Astronauts," 30.
39. Senate, *Project Mercury: Man-in-Space Program,* 67; House, "Qualifications for Astronauts," 28-30.

Astute problem-solvers were required, in part, because NASA justified its mission for putting humans into space based on the assumption that humans could deal with unexpected problems better than machines.

> It is becoming increasingly evident that full exploitation of the potentialities of spaceflight for benefiting mankind will be dependent on the development of practical capabilities for operating manned space vehicle. While it may appear in principal that suitable instrumentation may be devised to perform increasingly complex space missions, in practice the availability of a vehicle of human intelligence and operational capabilities will prove to be the most effective method for successful accomplishment of many advanced spaceflight missions. In particular, he can contribute to the tasks of space exploration and utilization an observational, analytical, and decision making ability concerning both expected and unanticipated problems, and a vast flexibility of action for operation, correction, and maintenance of scientific and technological instrumentation and equipment that characterize his present usefulness in airplanes and the scientific laboratory.[40]

In other words, problem-solving skills were needed because NASA deemed them a requirement. Such a tautology, however, misses the deeper importance of why problem-solving skills were vital the space program's success. NASA testified that "the pilot's duties will consist largely of reading instruments and recording observations. However, he will retain certain decision-making functions, and will be required to adapt to changing conditions as circumstances may demand."[41] More succinctly, astronauts needed to be system managers most of the time, and, on occasion, to intercede to right the ship.[42] Keeping a person in-the-loop provided insurance against the uncertainty of spaceflight.

An astronaut's intellect underwrote such insurance. Indeed, NASA required that Mercury astronauts "have a high level of intelligence, with abilities to interpret instruments, perceive mathematical relationship and maintain spatial orientation."[43] John Glenn echoed these requirements when he said,

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40. Senate, *Project Mercury: Man-in-Space Program,* 19.
41. Senate, *Project Mercury: Man-in-Space Program,* 63.
42. Hersch, *Inventing,* 30.
43. Wright Air Development Center, *Project Mercury Candidate Evaluation Program,* 81.

"The pilot has to monitor all of these gauges and lights continuously. He must be ready to move instantly to any switch on the panel if he sees a red light go on, or if he notices that a green light has failed to light up when it should have. This is one big reason a man is up there in the first place—to make sure that this machine works and to make the necessary corrections if something goes wrong, which could save us millions of dollars and months of effort."[44] Glenn's problem-solving prowess became necessary during his first flight to enable his safe recovery and that of his capsule.[45]

This theme, of justifying the expense of manned spaceflight by relying on a human's unique ability to solve inflight problems, remained constant. During a Congressional hearing on "the basic qualifications required for the selection and training of astronauts," Glenn elaborated on why technical skills and a proclivity towards solving complex problems were necessary.[46]

> The demands of just understanding the space vehicle systems requires a good technical background. It is an experimental program, also. In that regard, you use your judgment of past events, and past experience, of course, in applying this judgment to this new experimental area…One of the design criteria we are working on is just where the astronaut is an integral part of this system, not just a passenger who goes along for the ride, as a biological specimen. He is an integral working part of it.
>
> We feel that the astronaut brings several things into the program. He brings an adaptability, certainly, in his ability to make observations that instruments and other equipment cannot make. He also increases the reliability of the whole operation considerably by his ability to take over, manually, and his ability to analyze. He brings to it his judgment, and not only the judgment from his training, but also the judgment that he brings to the program from his past background and experience, which is at least, as large or larger than the training that he has been given.
>
> The astronauts' function is actually then to take over full control, to analyze, assess, and report the various things that he encounters, or new situations in which he finds himself. In doing this he must perform these functions under periods of high stress,

44. Carpenter*, et al.*, *We Seven,* 107.
45. Glenn, Oral History interview by Sheree Scarborough, 16.
46. House, "Qualifications for Astronauts," 1.

both mentally and physically, and observe many complex functions under these stresses.[47]

Solving complex problems in orbit, however, was not enough. NASA also sought individuals equipped with the capacity to solve the myriad problems associated with building a space program *ab initio*.[48] To help the agency in such an endeavor, NASA expected that its astronaut candidates would "gain knowledge of the concepts and equipment developed by others and, as their knowledge and experience develops, they [would] contribute their thinking toward insuring maximum success of the planned flights."[49] Furthermore, the agency expected its astronauts to "make tests and act as observers-under-test in experimental investigations designed…to help elicit the knowledge necessary to evaluate and enable the final development of communication, display, vehicle-control, environmental-control, and other systems involved in spaceflight."[50] Finally, astronauts were expected to perform research and technical advisory duties related to their educational background all with a vision of helping NASA build its space program.[51] As Charles Donlan noted in 1998, "we were looking for people who could really do the job and contribute information for that job."[52] Rocketing to the stars was going to be a project tackled by a team of problem-solvers.

Indeed, the ability to solve problems throughout Mercury's research, development, and testing phases was deemed so vital that NASA conducted numerous tests for screening applicants to make sure potential astronauts fit the bill. Part of this testing involved psychological exams, which NASA curtailed in subsequent astronaut selection processes. Other screenings tested for a candidate's "demonstrate[d] evidence of sufficient drive and creativity to insure *[sic]* positive contributions to the development of the vehicle and other aspects of the project as a whole."[53] Candidates also underwent a battery of

47. House, "Qualifications for Astronauts," 48-49.
48. Wright Air Development Center, *Project Mercury Candidate Evaluation Program,* 81. Here NASA states that candidates "should demonstrate evidence of sufficient drive and creativity to Insure *[sic]* positive contributions to the development of the vehicle and other aspects of the project as a whole."
49. "Invitation to Apply as Research-Astronaut Candidate," 2.
50. "Invitation to Apply as Research-Astronaut Candidate," 2.
51. "Invitation to Apply as Research-Astronaut Candidate," 2.
52. Donlan, Interview by Jim Slade, 14-15.
53. Wright Air Development Center, *Project Mercury Candidate Evaluation Program,* 81;

"Intelligence and Special Aptitude" testing to verify their mental compatibility with the space missions.[54]

Despite all of these tests, evaluators only saw statistically significant differences between the selected and non-selected candidates' "Total Psychological Scores" and "Similarities" portion of the Wechsler Adult Intelligence test.[55] This finding may actually be unsurprising given the significance NASA afforded psychological compatibility.[56] As the Mercury medical evaluators noted in their report, however, it was hard to glean other obvious correlations between the selects and their performance given the small sample of highly select individuals.[57]

Whether NASA could discern a potential astronaut's true perspicacity is not immediately apparent in the literature, but the accounts from astronauts Glenn and Deke Slayton reinforce the notion that problem-solving skills were essential to NASA.[58] As Glenn related, "One reason we were brought into the program in the first place was to give the equipment the same kind of appraisal, from the ground up, that we would apply to a new aircraft we were about to fly for the first time. The Mercury equipment was unusually intricate, so we ran

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National Aeronautics and Space Administration, *Project Mercury Summary,* 200.

54. Wright Air Development Center, *Project Mercury Candidate Evaluation Program,* 84.

55. Wright Air Development Center, *Project Mercury Candidate Evaluation Program,* 96-97. See also Chapters VII through X.

56. The psychological battery used, based on descriptions in Wright Air Development Center, *Project Mercury Candidate Evaluation Program,* suggests a high-level of subjectivity in scoring. One might infer that the evaluators close interaction with the candidates led to the development of personal preferences. The same team that developed preferences based on interaction was the same team that scored the psychological battery. In other words, there is nothing in Wright Air Development Center, *Project Mercury Candidate Evaluation Program,* to suggest that confirmation bias was not present based on the design of the experiments. Dr. Robert Voas, a member of the US Space Task Group, was the lead psychologist for the selection process and indicated in his interview with Neal Goss that the medical team was influential in the final selection process, although final decision-making authority resided with Charles Donlan. See Dr. Robert B. Voas (Department of Transportation psychologist and Former NACA and NASA psychologist), Interview by Neal R. Goss, May 1964, Transcript, Washington, DC, 9-11. The reader is also encouraged to read John Glenn's Oral History interview by Sheree Scarborough. During the interview, Glenn hints that there may have been some gaming of the psychological tests based on how the candidates thought they should answer to avoid disqualification. Hersch in Hersch, *Inventing,* 24. suggests the same.

57. Wright Air Development Center, *Project Mercury Candidate Evaluation Program,* 99.

58. Carpenter*, et al.*, *We Seven,* 68-73, 158-160.

into some extremely complicated problems."[59] The seven Mercury astronauts were experienced tinkerers and problem-solvers. Using these skills, the astronauts helped the program overcome many setbacks. Emphasizing the problem-solving aspect of an astronaut's work, Slayton "disarmed a room of test pilot critics" by explaining how despite the perception Mercury astronauts were following "monkeys into space," the test pilot's skill in solving design issues and helping fix deficiencies proved critical to the "future course of spaceflight."[60] Ultimately, prowess in distilling a complex and intricate problem into its salient pieces was key in selecting Mercury astronauts and in the astronauts NASA duties.[61]

Pioneering Spirit

The Mercury astronauts were selected based on numerous physical, psychological, and competency-based factors. Each astronaut, however, was more than just a test pilot, skilled in handling complex systems during extreme circumstances, or adept at solving difficult technical conundrums. The astronauts were also America's space pioneers. It was the pioneering spirit that made the astronauts who they were, and it is that spirit this work intends to explore with an eye towards a future USAF astronaut corps.

The reader might suggest that what actually led to an astronaut's selection was the fact he was a test pilot. In other words, an intrepid attitude is concomitant with piloting experimental aircraft. Such simplification, however, misses that all of the initial candidates were test pilots. What, then, distinguished between applicants? Moreover, just as in the discussion of problem-solving acumen, test pilots were, and are, not the only pioneers. If the USAF should endeavor upon building an astronaut corps, looking at the endeavoring spirit in potential inaugural members could prove valuable.

As Charles Donlan noted, his selection team appreciated when candidates recognized the novelty of the Mercury endeavor and its possibilities rather than the program's immediate challenges and negative aspects.[62] Going

59. Carpenter*, et al.*, *We Seven,* 158.
60. Hersch, *Inventing,* 31.
61. Hallion, *Test Pilots: The Frontiersmen of Flight,* 262.
62. Donlan, Interview by Jim Slade, 14, 19-22.

to space broadened humankind's horizons. Consequently, NASA needed people who, while maybe anxious over the risks associated with blazing trails, were, nevertheless, willing to brave new worlds.

If the press conference announcing the Mercury astronaut team was any indication, the seven men selected certainly epitomized the pioneer. For instance, Deke Slayton stated:

> As far as my motivation is concerned, I feel that this is the future of not only this country but the world. We have gone about as far as we can on this globe, and we will have to start looking around a bit. It is just a natural expansion of flight. I consider it in that light. It is an extension of flight and we have to go somewhere and that is all that is left. This is an excellent opportunity to be in on something new, to begin with.[63]

To Slayton, there was wilderness left undiscovered. Humanity's duty, then, was to explore that wilderness.

Similarly, John Glenn remarked that he thought it a dereliction of duty and an affront to the nation not to use his talents by participating in Project Mercury.[64]

> But my feelings are that this whole project with regard to space sort of stands with us now as, if you want to look at it one way, like the Wright brothers stood at Kitty Hawk about fifty years ago, with Orville and Wilbur pitching a coin to see who was going to shove the other one off the hill down there.
> I think we stand on the verge of something as big and as expansive as that was fifty years ago. I also agree wholeheartedly with Gus here. I think we are very fortunate that we have, should we say, been blessed with the talents that have been picked for something like this. I think we would be almost remiss in our duty if we didn't make full use of our talents. Every one of us would feel guilty I think if we didn't make the fullest use of our talents. In volunteering for something that is as important as this is to our country and the world in general right now. This can mean an awful lot to this country, of course.[65]

63. "Press Conference of Mercury Astronaut Team," 9.
64. "Press Conference of Mercury Astronaut Team," 9-10. Glenn echoes these ideas in *We Seven.*
65. "Press Conference of Mercury Astronaut Team," 9-10.

Gordon Cooper echoed the sentiment about the duty to explore space on behalf of the nation. Moreover, he alluded to the novelty of the endeavor and thought it "very interesting."[66] Finally, Scott Carpenter relayed that he felt proud to represent the United States when he said, "it is a chance to serve the country in a very noble cause. It certainly is a chance to pioneer on a grand scale. I am very happy and proud to have been given the opportunity."[67]

Espousing one's commitment while in front of a national audience is one thing. Possessing the fortitude to bear significant risk with concomitant unknown benefits is an entirely different matter. Accordingly, NASA's medical examiners set forth two requirements that captured the idea of an astronaut as pioneer and set forth a bevy of tests to ascertain among the final 31 candidates who best encapsulated these qualities.[68]

> He should demonstrate evidence of sufficient drive and creativity to insure [sic]] positive contributions to the development of the vehicle and other aspects of the project as a whole.
>
> He should not be overly dependent on others for the satisfaction of his needs. At the same time, he must be able to accept dependence on others—engineers, ground crews, and the like—when required for the success of the mission. He must be able to tolerate both close associations and extreme isolation.[69]

These two requirements, taken together, reflect that an astronaut, like the early pioneers in American history, required stamina. That is, an astronaut's ability to endure in the face of adversity was critical to his success and that of the space program. Moreover, the astronaut, like the solo adventurer, needed to be self-reliant, while also accepting help when available. Many problems and unknowns lay ahead for the men of Project Mercury.[70]

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66. "Press Conference of Mercury Astronaut Team," 10.
67. "Press Conference of Mercury Astronaut Team," 10.
68. Wright Air Development Center, *Project Mercury Candidate Evaluation Program,* 38, 49, 53, 60, 70-71, 81-86. In the discussion of these tests, the report clearly demonstrates that the examiners looked for motivation in the candidates. Quitting physical tests earlier than others reflected poorly while continuing a test despite obvious signs of pain reflected sheer determination.
69. Wright Air Development Center, *Project Mercury Candidate Evaluation Program,* 81.
70. Carpenter*, et al.*, *We Seven,* captures many of the technical problems that the early spacefarers encountered.

Only sheer determination would ensure that America would sustain its prestige on the international stage.[71] Part of that determination was required to keep trekking spaceward even in the face of doubt from the American populace. Program delays raised concerns among those uninitiated in aerospace research. The astronauts, like adventurers of many walks, had to persist while assuaging the concerns of their backers, which was not always an easy task.[72] Perseverance in the face of adversity was necessary. Alan Shepard believed his perseverant personality fit well with America's budding space program. In his words, "I think that's when I realized I was the sort of person that was objective enough and dedicated enough to do a good job. Then there was the challenge to keep doing better and better, to fly the best test flight that anybody had ever flown."[73]

While the drive to better oneself and continue the pursuit of spaceflight regardless of adversity, was critical, NASA sought pioneers whose motivation extended beyond selfish reasons. In spelling out this requirement, NASA explained, "[an astronaut's] motivation should depend primarily on interest in the mission rather than on exaggerated needs for personal accomplishment."[74] Therefore, determining an astronaut candidate's motivations became a vital part of the evaluation.[75]

The Mercury pioneers had to place mission before self. Yet, doing so was no easy task as the fame and notoriety the Mercury Seven received quickly became a source of conflict.[76] Chris Kraft, NASA's first flight director, and Charles Donlan agreed that few could have predicted how "famous these boys would become" and to what extent the fame would affect each astronaut.[77]

Despite not being able to forecast the implications of fame accurately, NASA was aware of other influences that affected an astronaut candidate's motivation to participate in Project Mercury. For example, interviewers asked about an aspiring astronaut's career goals, and if they were ready to leave their

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71. Senate, *Project Mercury: Man-in-Space Program,* 51.
72. Carpenter*, et al.*, *We Seven,* 158.
73. Francis French and Colin Burgess, *Into That Silent Sea: Trailblazers of the Space Era, 1961-1965,* (Lincoln, NE: University of Nebraska Press, 2007), 47.
74. Wright Air Development Center, *Project Mercury Candidate Evaluation Program,* 81.
75. Wright Air Development Center, *Project Mercury Candidate Evaluation Program,* 99.
76. Voas, Interview by Bob Sherrod, 3.
77. Donlan and Kraft, Interview by Robert Sherrod,

old career path behind.[78] Of the 69 interviewed, nearly all of the 37 who voluntarily dropped out the running, did so out of concern for their current service careers.[79] Robert Voas suggests that allure of the proven path to senior rank was too much for some to resist.

> We did have two or three that turned us down. The primary reasons for that were that the people we went to were, you know, like in their thirties and they were the outstanding men, we had seen their fitness reports, you know, and we were selecting them on that basis. They were the outstanding people, so it meant that they were going right along the steps that led to the very highest command in the service.
>
> And particularly in the more traditional service of the Navy, things you do at each point in your career, if you're going to go to flag rank.
>
> And most of the people we talked to had done each one of those and they had usually done it a year or two ahead of their peers so that they were right on that path. And, so it really took a lot too, for this because was -- you know, on the one hand, it's glamorous, but on the other hand it's a complete diversion from the golden path to command, the flag rank. That was one thing.[80]

Military service chiefs assured applicants that applying and participating in Project Mercury would not be held against them.[81] Despite such assurances, however, most candidates who declined NASA's invitations, believed otherwise.[82] Indeed, Walter Schirra explained that he realized he was going to lose many opportunities, namely command, something to which he aspired.[83]

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78. Voas, Interview by Neal R. Goss, 3.
79. Dille in Carpenter*, et al.*, *We Seven,* 9.
80. Voas, Interview by Neal R. Goss, 3. Voas also relates an entertaining story of how one Air Force officer declined, then accepted the invitation to apply a total of three or four times before finally declining. The officer had just recently received approval to complete his Ph.D. at MIT while the Air Force picked up the tuition.
81. Dr. Robert B. Voas (Department of Transportation psychologist and Former NACA and NASA psychologist), Interview by Summer Chick Bergen, 19 May 2002, Transcript, Vienna, VA, 19.
82. Voas, Interview by Summer Chick Bergen, 19.
83. French and Burgess, *Into That Silent Sea: Trailblazers of the Space Era, 1961-1965,* 205; Walter Schirra (NASA Astronaut), Interview by Roy Neal, 1 December 1998, Transcript, San Diego, CA, 4-5. Schirra's words in Carpenter*, et al.*, *We Seven,* 60-62. also indicate a reticence about going out for the astronaut team as he put it. Eventually, he decided he may as well "burn the bridges" that he already crossed and really try for the Project Mercury endeavor. Glenn also indicated that he would likely

Moreover, to Schirra, "no one had a place for [the astronauts] in the military" after working with NASA.[84] While later retrospection indicated hints of regret, Schirra, however, made the decision to serve his nation as it raced the Soviets into space.[85] A similar "urge to pioneer and to accept a challenge and then try to meet it," led Alan Shepard to apply to NASA.[86] Shepard, too, sensed an uncertainty in how such a decision would affect his career. Shepard's skipper, however, told him he thought he had nothing to lose by applying.[87] In Shepard's case, this belief was true.[88] Shepard made Admiral rank.

Overall, the men of Project Mercury embarked on a journey full of unknowns. Technical complexities, the dangers of spaceflight, and the uncertainties regarding their careers posed considerable risks. Still, each took the first step in the journey. Such sacrifice, which is not always present when there exists the promise of potential glory, was something NASA valued. It meant that its astronauts would help the fledging space agency reach orbit. The intrepid test pilots, capable of performing under pressure, unwavering in their desire to use their skills to solve complex problems, and possessing a selfless, pioneering spirit, guided the nation on its prestige-building mission.[89] These men's skills and their qualities, enabled America's first achievements in space and endeared these gentlemen to the nation.

Modern Astronauts

In numerous ways, NASA's current astronauts reflect the many qualities that resided in the Mercury astronauts. Part of these similarities may stem from the fact that the minimum qualifications for NASA astronaut duty have

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have been in line for command had he not taken the assignment with NASA. See Carpenter*, et al.*, *We Seven,* 36.

84. French and Burgess, *Into That Silent Sea: Trailblazers of the Space Era, 1961-1965,* 205.

85. Schirra, Interview by Roy Neal, 4-5.

86. Carpenter*, et al.*, *We Seven,* 66.

87. Carpenter*, et al.*, *We Seven,* 66.

88. Carpenter*, et al.*, *We Seven,* 66.

89. Meeting in the Cabinet Room of the White House, President John F. Kennedy, James Webb (NASA Administrator), Dr. Jerome Wiesner (Special Assistant to the President for Science and Technology), Edward Welsh (Executive Secretary, National Aeronautics and Space Council), 21 November 1962, Presidential recordings collection tape #63.

not changed appreciably since Mercury's time.[90] Applicants require a "Bachelor's degree from an accredited institution in engineering, biological science, physical science, computer science, or mathematics; at least 3 years of related, progressively responsible, professional experience obtained after degree completion or at least 1,000 hours pilot-in-command time in jet aircraft; ability to pass the NASA long-duration astronaut physical."[91]

Despite the similarities in minimum qualifications, the caliber of the few individuals qualified to be called "astronaut" has only increased since the time of Project Mercury. Robert Voas alluded to this fact when he mentioned that the second group of astronauts "tended to have masters' degrees, which none of the first seven had."[92] Dee O'Hara, a nurse with NASA through many of its programs, echoed, "They [the Mercury astronauts] were the best America had to offer. I'm not sure they would have passed muster today; they didn't have the scientific credentials and such that is part of being an astronaut these days."[93] Moreover, "By 1964, prime emphasis had shifted away from flight experience and toward superior academic qualifications. Applicants were invited on the basis of educational background alone. These were the scientist astronauts, so called because, as a minimum, applicants were required to have a doctorate level degree or equivalent experience in the natural sciences, medicine or engineering."[94] Even among the pilot astronauts, those from the last two classes (2009 and 2013) hold at least one Master's degree.[95] Such credentials indicate an ever-increasing excellence among each new astronaut class. Pamela Melroy emphasized this trend in a discussion with the author. She suggested that current classes are in an entirely different league based simply on pre-NASA achievements.[96]

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90. "Invitation to Apply as Research-Astronaut Candidate," 3-4; "Astronaut Candidate," USAJobs.gov, 15 December 2015, Accessed 1 April 2016, https://www.usajobs.gov/GetJob/ViewDetails/423817000.
91. "Astronaut Candidate."
92. Voas, Interview by Bob Sherrod, 2.
93. French and Burgess, *Into That Silent Sea: Trailblazers of the Space Era, 1961-1965,* 41.
94. National Aeronautics and Space Administration, *Astronaut Selection and Training,* (Washington, DC: NASA, 2011), 1.
95. "Astronauts."
96. Pamela Melroy (Deputy Director, Tactical Technology Office, DARPA and Former Space Shuttle Pilot and Mission Commander for NASA), In discussion with author, 9

Certainly, the most recent astronaut classes exhibit diverse and significant achievement beyond the bare minimum qualifications required by NASA. These men and women would have to since less than one percent of applicants are selected.[97] Indeed, even being labeled "Highly Qualified" is no small feat.[98]

Exemplary achievement, however, only earns the candidate an interview. Thus, what has led to successful selection? In other words, what does NASA value in its current and future astronauts? In answering the preceding question, this work will examine two qualities that NASA seeks in its astronauts, whether in recent classes or the current selection process. Those two qualities are the ability to work well as part of a team and to adapt to changing situations. The following sections will examine these two qualities in greater detail with an eye towards how they translate for building a future USAF astronaut corps.

Success or Failure as a Team

"From the NASA perspective, a team is commonly understood to be a collection of individuals that is assigned to support and achieve a particular mission."[99] Ever since Gus Grissom and John Young launched on their Gemini 3 mission, manned spaceflight has been a team effort for the spacecraft's occupants.[100]

> He knows he has been trained and put into space at great cost and effort, and he has a limited amount of time, especially during

February 2016.

97. National Aeronautics and Space Administration, *Astronaut Fact Book,* ; Felix A. Soto Taro, "NASA Astronaut Selection and Training" (Presentation, Universidad del Sagrado Corazon, San Juan, Puerto Rico, 26-30 March 2012).15-16.

98. Kelley J. Slack, Al Holland, and Walter Sipes, "Selecting Astronauts: The Role of Psychologists" (Presentation at the 122nd Annual Convention of the American Psychological Association, Washington, DC, 8 August 2014).4-5. Typically, an applicant has to score among the top 8% to be part of the "Highly Qualified" group. It is interesting to note that NASA had test pilots who turned them down during Mercury, however, the agency had a record-number of applications for the 2017 class. See "Record Number of Americans Apply to #beanastronaut At NASA," NASA, 19 February 2016, Accessed 1 April 2016, https://www.nasa.gov/press-release/record-number-of-americans-apply-to-beanastronaut-at-nasa.

99. National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health Decrements Due to Inadequate Cooperation, Coordination, Communication, and Psychosocial Adaptation Within a Team,* (Washington, DC: NASA, 1 January 2015), 8.

100. "Astronauts."

> a short shuttle mission, to perform the tasks set out for him efficiently. The precious data of the scientists on the ground, who have dedicated many years for this experiment, can be lost, the equipment can be damaged in such a way that it cannot be repaired in space, or worse still, his blunder can affect the safety of life on the spaceship. Even if such drastic errors are seldom, he is nevertheless under great stress—he has to get the work done quickly, so that the next scheduled event can take place as planned. This kind of stress affects him not only as an individual, but as a member of a team: His peers are watching him, and he knows full well, not only will any mistakes made affect their work as well, but he fails in their eyes in a similar manner as a member of a sports team, whose error can affect the success of the team as a whole.[101]

The preceding excerpt from NASA's *Psychology of Space Exploration* reflects the nature of current work in outer space. The astronaut, no matter how superlative, is human. Prone to the occasional error, how can an astronaut's mistakes affect the individual, the team, and its mission? The above quote indicates that NASA missions inherently require teamwork to be successful.

While there has not been a systematic attempt to measure how spaceflight affects "team cohesion, team composition, team training, or team-related psychosocial adaptation," NASA has increasingly recognized the importance of selecting astronauts who not only lack medical psychopathologies but who demonstrate a good fit for the roles and missions of an astronaut.[102] Some of these suitability tests include team exercises designed to "assess an applicant's ability to perform in a team."[103]

The emphasis on capacity to function in a team, however, was not always present in NASA's selection processes. In the beginning, NASA picked "male, military 'right stuff pilots'" because of their competency in handling acute

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101. J. Kass, R. Kass, and I. Samaltedinov quoted in National Aeronautics and Space Administration, *Psychology of Space Exploration: Contemporary Research in Historical Perspective,* Douglas A. Vakoch, ed., (Washington, DC: NASA, 2011), 3.
102. Slack, Holland, and Sipes, "Selecting Astronauts: The Role of Psychologists" (Presentation at the 122nd Annual Convention of the American Psychological Association, Washington, DC, 8 August 2014); National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health,* 7.
103. Slack, Holland, and Sipes, "Selecting Astronauts: The Role of Psychologists" (Presentation at the 122nd Annual Convention of the American Psychological Association, Washington, DC, 8 August 2014).

stress; now, social competency is more important as NASA eyes the future involving deep-space exploration missions.[104] In other words, "little thought [was] given to team-orientation or team skills" during the early astronaut selection processes.[105] Now, however, mission requirements dictate the need to screen for ability to be an effective team member. The inclusion of astronaut-scientists, and a wider array of "expertise, personalities, multinational crews, gender diversity, and ethnic diversity," however, made social competency and team performance increasingly important.[106]

The following excerpt from NASA's *Psychology of Space Exploration* explains the unique characteristics of long-duration, deep-space missions that make the ability to work in a team vital.

> The very character of natural environments typically guarantees that there will be at least some, if not substantial, periods of inaccessibility, lack of communication or contact, little accessibility of real-time support, and great demands on individuals and groups to engage in autonomous decision-making, problem-solving, conflict resolution, self-monitoring, and self-regulation. These demands inherently build in the potential for conflict with external mission support personnel and researchers who find adherence to mission schedules and timelines far easier to maintain than do those actually on the mission. Shared perspective between these groups becomes increasingly difficult to promote as mission duration, distance, and environmental demands play larger roles in daily decisions of the teams than do seemingly arbitrary mission schedules.[107]

More specific to future missions, NASA researchers provided the following opinion on selecting and cultivating effective team members.

> The crew on a mission to Mars expedition will live and work in a confined and isolated environment with a small number of teammates for an unprecedented amount of time. They will be limited to asynchronous communication with others outside of

104. A.W. Holland, "Operational Psychology" (Presentation at Decadal Survey in Life and Physical Sciences Space Conference, Irvine, CA, 20 November 2009).
105. National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health,* 11.
106. National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health,* 11.
107. National Aeronautics and Space Administration, *Psychology of Space Exploration,* 50.

> their crew given technology limitations and the extreme distance. Moreover, they will have to live with the knowledge that there is no option for them to return home prematurely. This level of extended isolation will exacerbate any potential conflicts among crewmembers as a function of personality or cultural differences. Each of the astronauts we interviewed noted the presence of such conflicts on the ISS.[108]

There is a recognition that long-duration missions will require greater crew autonomy, which will "impact psychosocial adaptation to spaceflight demands."[109] By screening better for "Select Out" conditions and testing for suitability, NASA hopes to hire individuals who fit the "whole person" concept.[110] In other words, NASA seeks people who possess what are deemed the top five needed skills for long-duration missions (sociability, adaptability, motivation, communication, and teamwork) while still emphasizing the essential technical skills required for increasingly difficult technical challenges.[111]

NASA seeks people with those five skills for one reason, team performance. Of the three risks that NASA's Human Research Program Behavioral Health and Performance manages, only Team Risk is predominantly performance-based compared to health-based.[112] As stated in the introduction to this section, a team is designed to perform a particular mission. Thus, if coordination, cooperation, and psychological well-being are all vulnerable to the challenges of "social isolation, physical confinement, a small and diverse crew, communication delays between crew and ground…and a high consequence environment," extant in future long-duration missions, then team performance

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108. Kimberly A. Smith-Jentsch*, et al.*, *Training "The Right Stuff": An Assessment of Team Training Needs for Long-Duration Spaceflight Crews,* (Washington, DC: NASA, September 2015), 25.
109. National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health,* 17. Dr. A.W. Holland, a leading medical researcher at NASA's Johnson Space Center, states that "The most important factors in the success of long-duration missions are psychological." See Holland, "Operational Psychology" (Presentation at Decadal Survey in Life and Physical Sciences Space Conference, Irvine, CA, 20 November 2009).
110. National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health,* 15.
111. National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health,* 12-15.
112. National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health,* 8.

will suffer.[113] In deep-space, the crew cannot put the mission on hold. Hence, selecting individuals who exhibit the characteristics most amenable to team efforts is of vital importance. NASA and its astronauts have learned, on multiple and tragic occasions, the lessons of poor teamwork. Breakdowns in team cohesion and increasing group conflict were both linked to the Challenger and Columbia accidents.[114] Furthermore, "some missions may have been jeopardized and, possibly, terminated as a result of interpersonal frictions in the past;" therefore, "reducing team conflict, maintaining cohesion, and developing appropriate countermeasures," through the deliberate selection of the best team-oriented individuals is key.[115]

While research on the techniques to detect teamwork skills is still nascent, a more arcane tool provides some insight.[116] Pamela Melroy and Dr. Steven Swanson, both former Shuttle astronauts, shared their take on what NASA seeks in potential astronauts. One of the biggest things the agency looks for is whether the agency would be willing to call an individual one of their own for the next decade.[117] NASA becomes, more-or-less, stuck with an individual once selected for its astronaut corps. Accordingly, the litmus test of "is this a person we could tolerate for the next few years" is useful.[118]

A marriage analogy is also helpful in describing how well a potential astronaut integrates into the agency. One anonymous astronaut interviewed *Training the Right Stuff,* drew a parallel between marriage and crew interactions.

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113. National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health,* 7; J.D. Barrett, A.W. Holland, and W.B. Vessey, *Identifying the "Right Stuff": An Exploration-Focused Astronaut Job Analysis,* (Washington, DC: NASA, 1 January 2015),
114. Launius quoted in National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health,* 23.
115. National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health,* 58.
116. National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health,* 7.
117. Melroy, In discussion with author; Steven Swanson (Distinguished Educator in Residence and Professor of the Practice Division of Research and Economic Development, Boise State University and Former NASA Astronaut), Interview by author, 13 January 2016.
118. This litmus test accords with the literature in that NASA looks for those who "can live well with others." See National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health,* 15.

The analogy was useful in describing the interpersonal dynamic once embarked upon a long-duration mission.

> "You know it's sort of just like being married [laughing]. Dating is great but then when you start to throw your shoes around or you don't clean the toilet ever, people start getting tired of you. It's the same type of thing on here, just being conscious of your stuff, and where it is and what it's doing. That's the thing that I emphasized and you know we joke around because up in the office you can see who has a clean desk and who has got the messy desks and just you know that crewmember's going to be like that...[119]

Because of an increased emphasis on ensuring team performance through crew cohesion, NASA has, over the last half-century, transitioned its selection process from looking almost exclusively at technical and acute stress competencies to a modicum of technical and social adroitness. Success in a space mission was never solely about technical know-how, but the challenges of deep-space exploration require a renewed emphasis on both technical and social competence. By targeting astronaut applicants who demonstrate an ability to work well in teams, NASA minimizes Team Risk.[120] In "period[s] of intense activity (e.g., arriving at Mars to begin exploration)," "crews must use a wide range of problem-solving and teamwork skills, as well as shared cognition, to work efficiently."[121] Mission success depends upon teamwork.

Adaptability

NASA not only seeks teamwork skills in potential astronauts; it also seeks people with demonstrated adaptation abilities.[122] "Adaptability skill has been defined as the ability to alter a course of action or team repertoire in response to changing conditions."[123] In part, "Individual adaptation can indeed

119. Smith-Jentsch, *et al.*, *Training The Right Stuff*, 24-25.
120. National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health,* 15.
121. National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health,* 22.
122. Interestingly, NASA only recently rekindled an interest in studying the psychology of its astronauts. See National Aeronautics and Space Administration, *Psychology of Space Exploration,* 17.
123. Smith-Jentsch, *et al.*, *Training The Right Stuff*, 29.

influence team processes and outcomes."[124] "Adaptability may also allow for greater ease in switching between tasks, leader and follower roles, interdependent versus independent work without incurring performance decrements."[125] One of the factors that enable effective teamwork is an ability to adapt.

While NASA values adaptation skills in its astronauts, these skills are not valued simply because of their influence on team dynamics. Such adaptation is termed "interpersonal-focused."[126] NASA also values the ability to adapt to changing missions and tasks; this is "task-focused" adaptation.[127] As this author showed in the discussion of Project Mercury's astronauts, NASA partly sought test pilots because of their proven ability to handle stressful situations, to adapt to unknowns, and to accomplish the mission despite mounting uncertainty. Ability to do these things was required to ensure the man and his capsule returned to Earth safely. In those relatively short missions, how an astronaut handled unforeseen emergencies mattered the most.[128] The Mercury astronauts were adept at task-focused adaptation.

While task-focused adaptation is still important in handling unexpected emergencies, the nature of long-duration missions (whether in low-Earth orbit or especially beyond Earth's orbit) suggests that essential short-term adaptability gives way to a need for long-term, task-focused adaptation skills.[129]

> A long-duration mission is very different... you have to make this transition from dynamic crew working together in a cohesive way, to a crew working efficiently, in orbit, with less schedule pressure and lack of ability to postpone events that you miss. And so that means the crew now has to really shift gears. Once you're docked at the space station, now you've gone from... airplane mode to camper mode for sure.

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124. National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health,* 14.
125. National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health,* 14.
126. Smith-Jentsch*, et al.*, *Training The Right Stuff,* 30.
127. Smith-Jentsch*, et al.*, *Training The Right Stuff,* 30.
128. National Aeronautics and Space Administration, *Project Mercury Summary,* 26, 189.
129. Smith-Jentsch*, et al.*, *Training The Right Stuff,* 20-21.

> ...those first few weeks [on the ISS] are pretty laid back, in terms of tempo compared to space shuttle.
>
> That transition from dynamic operations where everyone's a crew, extraordinarily well trained and prepared sitting on a launch pad and launching, and everyone works, speaks in turns ... no one is out of turn, everyone knows their role and there's a huge efficiency. Up to the point where they start to get out of their seats and break out... fold out chairs, and start acting like in a galley. At that point it starts to turn into a camper and then things are unpredictable.[130]

In transitioning from the dynamic nature of launch, the astronaut must now adapt to living aboard a small spacecraft with other, very different people.[131] NASA recognizes that this transition, while not easy for some, is vital to accomplishing mission objectives and overall team performance.[132] Accordingly, the agency uses social competency screening to determine how well an astronaut will adjust to differences in mission tempo.[133] Nevertheless, the requirement to adapt based on a changing crew may be an artifact of the nature of International Space Station missions.[134] Missions to an asteroid or Mars will likely keep a crew intact.[135]

The essentialness of adaptability, however, extends beyond being able to intermix with different personality types. Adaptability, in the form of task-focused adaptation, becomes important not only in transitioning from dynamic to more stable mission phases but also in the transition from stable to dynamic phases.

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130. Smith-Jentsch, *et al.*, *Training The Right Stuff,* 20-21. These quotes were from anonymous NASA astronauts experienced in long-duration International Space Station missions. What these quotes show is that the stressful highly dynamic qualities of launch soon give way to a more stable period of the mission once aboard the station. While there is a certain stability in the nature of long-duration missions, the very fact that the missions' times are long means the probability increases that unexpected events will occur.
131. Smith-Jentsch, *et al.*, *Training The Right Stuff,* 23.
132. National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health,* 22.
133. National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health,* 22.
134. Smith-Jentsch, *et al.*, *Training The Right Stuff,* 23.
135. Smith-Jentsch, *et al.*, *Training The Right Stuff,* 3.

> That transition from non-time-critical ops to dynamic operations is a key transition for any team, and it's one that I think needs to be formally recognized as a transition that should be practiced and briefed.
>
> I believe that the greatest danger is this pitfall where a crew member, where a crew can make a mistake, because they didn't transition from the laid back to the dynamic ops.
>
> When you come to a dynamic operation, where you have irreversible, physical events, events that have very, very, very costly, consequences, and possibly safety ones, the great danger is that you wake up after a month of same routine every day the task list of doing (name)'s experiment and then suddenly, this day, you now have to do the spacewalk and you just don't ramp up fast enough in terms of attention to detail, and crispness of the time line.[136]

The above astronaut comments reflect the importance of fluidity. In other words, NASA needs astronauts who can adapt to the rigors of dynamic spaceflight, be agreeable team members for a lengthy sojourn aboard a space station or craft, and then quickly adjust back to dynamic tasks, such as landing on Mars. "For example, astronauts on a mission to Mars will likely have extended periods of boredom as they travel extremely long distances, but then will have to shift gears and engage in intense or highly focused activity in emergency situations or for scheduled experiments."[137] NASA researcher Kimberly Smith-Jentsch captured this concept of fluidity well in her team's study conducted to "identify unique factors associated with the tasks, team member characteristics, and the organizational environment likely to affect long-duration spaceflight team training needs."[138] Smith-Jentsch writes, "Through our analysis, we have noted that there are certain re-occurring changes in situational demands that long-duration spaceflight crews must adapt to. These are changes in tempo/pace, changes in team size, and changes in task interdependency. As a result, we recommend that training be developed to train crewmembers to anticipate and effectively adapt to these specific

136. Smith-Jentsch, *et al.*, *Training The Right Stuff*, 29.
137. Smith-Jentsch, *et al.*, *Training The Right Stuff*, 21.
138. Smith-Jentsch, *et al.*, *Training The Right Stuff*, 1.

changes."[139] In effect, NASA needs astronauts who can transition smoothly between task types and loads.

So far, discussion of adaptability has revolved around adapting to changing team dynamics (interpersonal-focused adaptation) and to shifts in mission intensity from, high activity to low activity and vice versa (task-focused). There is another reason NASA values adaptability. Future long-duration space missions, due to their longer mission times, will have a naturally higher occurrence of unexpected events and emergencies. Probability, at least, suggests as much. Certainly, NASA will train its crews to handle the most likely and worst-case exigencies, but few can predict all that could go wrong.[140] Emergency training, however, only ensures that all of the astronauts are trained "on most of the tasks that are critical to their safety," which gives an interchangeability concerning some skill sets.[141] Not all skills, however, are interchangeable. Thus, when the unexpected occurs, and a predefined skill set no longer proves directly relevant, adaptation must occur. Otherwise, the mission could fail.

To prevent mission failure, NASA looks for "adaptive transfer" to occur. "Adaptive transfer involves the use of one's existing knowledge base to generate a solution to a completely new problem."[142] Future astronauts will face "highly unstable" environments and will need to perform "highly variable tasks that cannot be anticipated ahead of time."[143] The ability to adapt enables the team to take in the new context, apply previous knowledge, and then adjust to differences to surmount present obstacles. Adaptability helps the astronaut team overcome variability in mission tempo and unpredictable variability in task type.[144] No team can prepare for all contingencies. By selecting individuals who exhibit adaptive capabilities, and then further honing those skills through interpersonal and task-focused adaptation training, NASA hopes

139. Smith-Jentsch, *et al.*, *Training The Right Stuff*, 30.
140. National Aeronautics and Space Administration, *Astronaut Selection and Training,* 2; Smith-Jentsch, *et al.*, *Training The Right Stuff,* 35.
141. Smith-Jentsch, *et al.*, *Training The Right Stuff*, 35.
142. Smith-Jentsch, *et al.*, *Training The Right Stuff*, 14.
143. Smith-Jentsch, *et al.*, *Training The Right Stuff*, 14.
144. Smith-Jentsch, *et al.*, *Training The Right Stuff*, 2, 21.

to mitigate the uncertainties and risks concomitant with deep-space exploration.[145]

Ultimately, social competence, or the ability to work well in a team, is buttressed by an individual's adaptability.[146] Conversely, well-integrated and cohesive teams tend to be more resilient, thus perform better, which increases the adaptability of each member.[147] The continual feedback loop that fosters cohesion and makes the whole greater than the sum of the parts will necessarily sustain future deep-space exploration.[148] A Mars mission *will* present challenges to the astronaut crew. Moreover, while popular culture may only tangentially concern itself with scientific reality, there are valuable lessons in Andy Weir's *The Martian.*[149] The main character's adaptability and resilience in the face of dire conditions, and the cohesion and commitment his crew mates displayed throughout proved monumental to his safe recovery and voyage home.

Implications for a Future USAF Astronaut Corps

To this point, this work explored two case studies regarding astronaut selection for Project Mercury and modern NASA astronauts. While the qualities extracted from the author's research is informative to the space enthusiast, the conclusions drawn forth may not prove immediately relevant to the USAF and

145. Smith-Jentsch*, et al.*, *Training The Right Stuff*, 36-46. See also National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health,* 50-54. There has been some fascinating research conducted on individual and team adaptation and resilience in extreme environments such as the Antarctic research stations. NASA has concluded that there can be a feedback loop whereby adaptive individuals enhance team resilience and adaptability. In turn, the team performs better, which boosts the resilience of the individual. In conducting research for this work, the author spoke with two former astronauts, Pamela Melroy and Dr. Steven Swanson. Both indicated that NASA's astronaut selection teams appreciate applicants who show a proclivity for analogs to Isolated, Confined, Extreme (ICE, see *Risk of Performance and Behavioral Health Decrements*, pg. 7) events. Camping, backpacking, and long-duration field studies are but a few examples. In theory, an interest in these activities shows that an individual can handle bouts of isolation and is somewhat comfortable with activities that may require adapting to changing conditions.
146. Smith-Jentsch*, et al.*, *Training The Right Stuff*, 50-54.
147. Smith-Jentsch*, et al.*, *Training The Right Stuff*, 12-13, 50-54.
148. National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health,* 40.
149. Melroy, In discussion with author. Melroy stated that she uses this piece of pop culture to illustrate the importance of teamwork and resiliency especially for future long-duration, deep-space missions.

strategy. The intent of this section, therefore, is to divine some propositions the USAF should consider in constructing a future USAF astronaut corps. To that end, this section will step through each of the five characteristics gleaned from the Project Mercury and modern-day astronauts as well as discuss necessary legal regime considerations should the USAF embark on this journey of building astronauts. This study revealed that real-world factors and theory-based reasoning suggest a most likely role for Airmen astronauts. That role is as space police. The author will attempt to apply the previous case studies' observations to shed light on how the USAF could cultivate its Airmen to fulfill the role of space guardian.

Are Test Pilots Needed?

NASA sought test pilots, and still accords them special consideration during selection processes, because of training that imbued the test pilot with experience handling unfamiliar systems and aircraft in an environment replete with uncertainty and danger.[150] As the author's former Test Pilot School Commandant stated, "Mother Nature hid some secrets from us, and she hid them in a very hostile place -- the sky."[151] Yet, as Scott Carpenter suggested, "there is nothing magic about a test pilot."[152] It is the training and experience that gives the test pilot the ability to "act when action is appropriate, but refrain from action when inactivity is appropriate," and possesses "flawless judgement *[sic]*, fast reaction, and the ability to transmit that to the proper control of the craft."[153]

Assuming the USAF were to construct an astronaut corps, it should emphasize selecting individuals who demonstrate some of the traits and skills mentioned in this work. Equally important, however, is the need to train and

150. Carpenter*, et al.*, *We Seven,* 71. NASA's online application form specifically asks whether the applicant is a graduate of a recognized test pilot school. See "NASA - Apply Online," NASA.gov, Accessed 5 April 2016, https://applyonline.nasa.gov/status.
151. Macario Mora, "Four Pilots Selected for Test Pilot School," *Air Force,* 2 April 2012, Accessed 5 April 2012, http://www.luke.af.mil/News/ArticleDisplay/tabid/3070/Article/358794/four-pilots-selected-for-test-pilot-school.aspx.
152. House, "Qualifications for Astronauts," 50.
153. Wright Air Development Center, *Project Mercury Candidate Evaluation Program,* 81; House, "Qualifications for Astronauts," 13.

refine these skills. Just as the USAF pilot, missileer, or satellite operator continually hones their skills in their professional craft, the USAF would need to ensure its astronauts exercised their minds and bodies to prepare for the inherent uncertainties of spaceflight.

The mission of space police would likely require long-duration missions. A typical mission to Mars requires, at least, six months transit time.[154] Moreover, the vastness of the inner solar system suggests a continual presence is required.[155] In other words, simply launching based on need alone may not be responsive enough to assist those the astronaut force was designed to protect. The ability to handle uncertainty and deal with unexpected emergencies would likely prove critical to accomplishing the mission of guardians of space.

Where test pilots may be needed, due to their specific experience in developing and testing systems, would be in the initial fielding of spacecraft. While the ability to react quickly and correctly under duress and the familiarity with unfamiliarity would still prove useful in a USAF astronaut corps, these traits are not the sole domain of the experimental test pilot. Vetting aircraft, or in this case spacecraft, however, is the sole dominion of the test pilot. Consequently, the initial cadre of astronauts may well be test pilots but transition to operational pilots just as happened in the F-22 and F-35 communities.

What Kind of Problem Solvers?

The USAF should seek more than the traits of a trained test pilot; it should also seek people who are capable, intelligent problem-solvers. Future Airmen astronauts should be canny problem-solvers in the technical realm. As previously discussed, a space police force must be in the environment to act as guardian. Moreover, space policing will require long-duration missions, and in deep-space, there may not be an option to return home within a short period.[156]

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154. Claude A. Piantadosi, *Mankind Beyond Earth: The History, Science, and Future of Human Space Exploration,* (New York, NY: Columbia University Press, 2012), 189-190.
155. Everett C. Dolman, "Astropolitik: A Case for Weapons in Space" (Lecture, School of Advanced Air and Space Studies, Maxwell AFB, AL, 7 March 2016); Piantadosi, *Mankind Beyond Earth,* 46.
156. Smith-Jentsch*, et al.*, *Training The Right Stuff,* 25.

Consequently, the USAF will require unflappable individuals who can leverage their unflappability to fix unexpected quandaries even while under duress.

The rescue aspect of space policing will also require technical know-how and problem-solving skills. Much akin to modern pararescue, some future USAF astronauts will need a broad swath of technical expertise to perform a rescue, whether it be a stranded asteroid miner or hostages on a Moon settlement. Terrestrial rescue is no simple task, yet the rescuer can count on constants like gravitational forces and the tides. In space, the myriad possible scenarios requiring rescue dictates building an astronaut corps filled with resourceful problem-solvers.

Adaptable Airmen

A future astronaut corps will not only require astute problem-solvers, but it will also demand adaptability. Whether the USAF ever builds an astronaut corps is, in this author's estimation, contingent on the extent of American and international commercial activity in space. In other words, guardians will follow the merchants similar to the idea that "flag follows trade."[157] As spacefaring actors transit new horizons, new worlds, new opportunities, and new dangers await.

These new horizons and their concomitant novelties imply new requirements for adaptability if NASA's research is any indicator.[158] The astronaut police team, on-station for months at a time, must adjust to increasing mission durations. Moreover, the new environments will require individual and group adaptation without which the unit and mission will fail.

Just as NASA discovered that it must screen for adaptability, so too will the USAF.[159] Consequently, the USAF will have to eschew the more concrete

157. Scott Pace, "Merchant and Guardian Challenges in the Exercise of Spacepower," in *Towards a Theory of Spacepower*, ed. Peter L Hays, and Charles D Lutes (Washington, DC: National Defense University Press, 2007), 127-151; Peter L. Hays, *United States Military Space: Into the Twenty-First Century,* (USAF Academy, CO: USAF Institute for National Security Studies, 2002), 10, 31; Peter L Hays, *Space and Security: A Reference Handbook,* (Santa Barbara, CA: ABC-CLIO, 2011), 64.
158. National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health,* 7-8, 24-25, 58.
159. National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health,* 25-27.

metrics it uses for many of accessions into its operational career fields.[160] Certainly, adaptability can be sharpened through training as *Training the Right Stuff* suggests, but adaptability can only be cultivated to an extent.[161] Screening for this trait will require new methods. Borrowing from NASA may prove prudent. The rigors of guarding the galaxy, and the adaptability to adjust to, and overcome, the challenges posed by a violent solar system, will be essential to an Airman astronaut's mission.[162]

Building a Team

In many ways, filling a future astronaut corps with coolheaded individuals, who are adaptable and technically capable, should suffice in meeting another requirement critical to such a corps. That requirement is for the USAF's astronauts to be adept at working together in teams. NASA's research on determining the make-up of good team players certainly suggests that individuals possessing the qualities mentioned above tend to be good team players.[163] NASA, however, also concluded that diversity in skills and expertise can be a source of disunity among a team.[164] Why does this finding matter?

If there is any validity to the idea of using military astronauts as a police force, then one can make inferences about the nature of the potential duties this force might perform. In other words, while it is beyond the scope of this work to determine the exact form a USAF astronaut corps would take, there is a current analog that provides insight on why team dynamics would matter for a future astronaut corps: the current USAF combat rescue force.

> The primary mission of Air Force Rescue is to use a combination of specially trained Airmen and systems to recover isolated personnel. Diverse skill sets allow dedicated personnel rescue forces to accomplish many collateral missions. These collateral missions may include: casualty evacuation, civil search and rescue, counter-drug activities, emergency and/or traditional

160. Air Force Instruction 36-2205, *Applying for Flying Training, Air Battle Manager, and Astronaut Programs,* 17 February 2009.4-5.
161. National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health,* 25-27.
162. Piantadosi, *Mankind Beyond Earth,* 136-181.
163. Smith-Jentsch*, et al.*, *Training The Right Stuff,* 12-13, 50-54.
164. National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health,* 11, 15, 19, 38.

> aeromedical evacuation, homeland security, humanitarian relief, international aid, non-combatant evacuation operations, support for National Aeronautics and Space Administration (NASA) flight operations, mass rescue operations, theater security cooperation, specialized air and ground mobility, personnel rescue command and control and the complex reintegration, infiltration and exfiltration of personnel in support of air component commander missions, special operations missions, and rescue of special operations forces.[165]

A space police force may not perform many of the above missions. Based on a role as space guardian of some future merchant class, however, one could foresee relevance easily in such missions as casualty evacuation, civil search and rescue, emergency and traditional aeromedical evacuation, homeland security, humanitarian relief, international aid, non-combatant evacuation operations, mass rescue operations, and theater security cooperation.[166] Just as the modern combat rescue Airmen specializes in some but not all of these missions, so too would a future Airman astronaut. Consequently, any on-duty space police team would inherently possess varying skills and areas of expertise. A diversity of specialization, when coupled with long-duration missions (remember the discussion on the vastness of space), can lead to issues of team cohesion. Team disunity, in turn, affects performance.[167] Logic demands that team dynamics will be of great import on future space policing missions.

How then should the USAF proceed in constructing an astronaut corps filled with well-balanced team players? The USAF should follow NASA's suit. As discussed in the previous section, a "scientifically-based selection of a team-oriented personality, paired with deliberative team composition, predicts team performance, cohesion, team processes, and well-being."[168] Accordingly, the USAF should seek those with the requisite skills needed for space policing, whatever form those skills finally take. The USAF should also select individuals

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165. Air Force Doctrine Annex 3-50, *Personnel Recovery,* 4 December 2014.4.
166. "Air Force Doctrine Annex 3-50," 4; Pace, "Merchant and Guardian Challenges in the Exercise of Spacepower," 133-134.
167. National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health,* 7; Barrett, Holland, and Vessey, *Identifying the "Right Stuff": An Exploration-Focused Astronaut Job Analysis,*
168. National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health,* 10.

who best demonstrate "emotional stability, agreeableness, self-care, motivation, sociability, team-orientation, leadership/followership flexibility, adaptability and resilience" since these traits aid "team performance and functioning."[169]

Furthermore, the USAF would need to buttress these initial interpersonal skills with rigorous training similar to what is currently done in many USAF career fields.[170] Focusing on training that fosters better cooperation, communication, conflict management, coordination, cognition, and leadership/followership interactions should imbue the astronaut teams with the necessary skills to accomplish the mission of space guardian.[171] Moreover, "training should be reinforced regularly, and training programs should use multiple methods to target the same skills across training events."[172] Finally, "training as an intact team long before the launch date of the mission is paramount" much in the same way that the modern-day fighter squadron travels to Red Flag, Green Flag, and Combat Hammer before deploying.[173] Training in exercises readies the unit for the rigors of the upcoming operational deployment.

Ultimately, many current airpower missions require teamwork. Perchance the biggest difference, however, between today and a future space policing mission is the isolation factor. An on-station police team may not have the luxury of returning to base and will be autonomous in many ways. Their ability to perform links intricately with their ability to function as a team.

Who Will Go?

Without a doubt, America's Airmen embody the ethos found in the biblical passage from Isaiah. When the United States asked who would bear the mantle of defense for the nation, every woman and man answered, "Here I

169. National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health,* 27.
170. National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health,* 35.
171. National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health,* 35-45.
172. National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health,* 45.
173. National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health,* 45.

am! Send me."[174] Thus, it seems that the USAF is not found wanting for pioneers, those plucky individuals who willingly eschew the comforts of the known for the potentiality of the unknown. This author certainly could not assert to the contrary; however, the type of pioneers needed to participate in the launch of an astronaut corps must exhibit a pioneering spirit that is different from the willingness to defend the nation.

The Project Mercury astronauts demonstrated such a trailblazer attitude to which this author alludes. The Mercury Seven sacrificed the "proven" path to career success for the uncertain path associated with America's space endeavors.[175] The initial cadre of a USAF astronaut force might face similar dilemmas. To wit, Airmen astronauts must answer whether to continue down the road to success, following mentors and predecessors, or choose to blaze new paths with less certainty of attaining professional triumph.[176]

The USAF encountered similar situations in its past. One such example exists currently in the remotely piloted aircraft career field. Brookings Institution Fellow, Bradley Hoagland, identified one characteristic of the remotely piloted aircraft career field that dissuaded volunteers from retraining into the unmanned weapons systems.[177] The lack of career development and advancement opportunities deemed critical by the USAF writ-large do not exist for remotely piloted aircraft operators. Without opportunities to progress at rates commensurate with the broader USAF, officers in the remotely piloted aircraft specialty separate from the service when given the chance. Would a future astronaut force experience similar apparent disadvantages? Possibly. Therefore, the USAF should heed the wisdom of Stephen Rosen. In *Winning the Next War,* Rosen examines the engine behind military innovation and technological advancement. He concludes, using such examples as Admiral Bill Moffett's early naval aviators, that "peacetime innovations are possible, but the

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174. Is. 6:8
175. Voas, Interview by Summer Chick Bergen, 19; Carpenter*, et al.*, *We Seven,* 36, 66.
176. The author, here, assumes that any individual talented enough to become a member of the initial cadre for a nascent USAF astronaut corps would likely have demonstrated considerable achievement prior to his/her selection.
177. Bradley T. Hoagland, "Manning the Next Unmanned Air Force: Developing RPA Pilots of the Future," *The Brookings Institution,* August 2013, Accessed 7 April 2016, http://www.brookings.edu/research/papers/2013/08/06-air-force-drone-pilot-development-hoagland. 12-15.

process is long."[178] To get much-needed new blood into the system, new promotion pathways must open.

> The organizational struggle that leads to innovation may thus require the creation of a new promotion pathway to the senior ranks, so that young officers learning and practicing the new way of war can rise to the top, as part of a generational change. The new pathway may be necessary to ensure that new skills are not relegated to professional oblivion. If a new skill is defined as a technical specialty, the officer with that skill will not be seen as having the broad background that qualifies him for the rank of general or an admiral…this perspective suggests that peacetime military innovation occurs when respected senior military officers formulate a strategy for innovation, which has both intellectual and organizational components.[179]

Constructing an astronaut corps entails more than cultivating personnel and building physical infrastructure. To borrow a botanical analogy, an astronaut corps requires roots, xylem, and phloem (infrastructure) by which the nutrients (personnel) move to sustain the plant. If there are no xylem and phloem to "the top," or pistil, then the corps will not reproduce. Thus, the USAF must create pathways to promotion for its astronauts, both for those participating in the launch of the corps and for follow-on generations. Failing to do so would create a disincentive for retention and recruitment that could squander the highly refined expertise found resident in the astronaut corps. Such an oversight may equate to mission failure. Any future astronaut corps will need pioneers. The USAF will need Airmen, who are not afraid of career implications, to venture into the unknown. Some career sacrifice may be required since promises of advancement only prove true in retrospection. Yet, the USAF cannot avail itself of this sacrifice without due consideration on how

178. Stephen Peter Rosen, *Winning the Next War: Innovation and the Modern Military,* (Ithaca, NY: Cornell Univ Press, 1994), 76-80, 105. Stephen Rosen's argument boils down to the fact that military innovation does not require an outside influence, in the form of pressure from civilian leadership, as his former dissertation supervisor, Barry Posen suggests in Barry R. Posen, *The Sources of Military Doctrine: France, Britain, and Germany Between the World Wars,* (Ithaca, NY: Cornell University Press, 1984), 288. Instead, innovation can occur endogenously, but can be slower than if an outside influence sparks the change. Moreover, peacetime innovation takes more time than in war. Rosen argues for his hypotheses using case studies involving successful and failed innovations (see pg. 6 for a listing of the case studies analyzed).
179. Rosen, *Winning the Next War: Innovation and the Modern Military,* 20-21.

it will nurture continued innovation. As Rosen writes, "innovation has been possible when senior military officers with traditional credentials, reacting not to intelligence about the enemy but to a structural change in the security environment, have acted to create a new promotion pathway for junior officers practicing a new way of war."[180] If the future international system includes considerable commercial efforts in space, then a space police will likely be required. While not a new way of war, there would be a novelty in the mission. The USAF's leaders can ensure mission success, in part, by clearing the path for the trailblazing astronaut corps.

Final Considerations

As alluded to in the previous section, "Who Will Go?" the author intimated that an astronaut corps requires both personnel and infrastructure. An exhaustive discussion on infrastructure is beyond the scope of this work; however, Brent Ziarnick raises some compelling ideas in his tome regarding nuclear-powered rockets.[181] According to Ziarnick, "Many space enthusiasts now say that we have reached the peak of what we can do with the liquid chemical rocket (though many also disagree) and for spacepower to be significantly enlarged again we would need a much more powerful engine, such as nuclear thermal rockets."[182] Moreover, advances in the 1960s showed that nuclear rocket propulsion is feasible and gave engineers a clear understanding of the avenues available to see nuclear-powered propulsion come to fruition.[183] At some point, if the USAF builds an astronaut corps, it will need to evaluate the hardware required for space missions.

Another issue the USAF need consider relates not to physical infrastructure per se, but rather to the legal infrastructure surrounding the fielding of an astronaut corps. Whereas current Airmen usually operate under Title 10 authority, and occasionally Title 50 authority, future Airmen astronauts may require a broader legal umbrella from under which they may execute the

180. Rosen, *Winning the Next War: Innovation and the Modern Military,* 251.
181. Brent Ziarnick, *Developing National Power in Space: A Theoretical Model,* (Jefferson City, NC: McFarland, 2015), 92-96, 111, 214.
182. Ziarnick, *Developing National Space Power,* 111.
183. Ziarnick, *Developing National Space Power,* 227.

missions required of them.[184] If astronauts are used purely as space "soldiers," then little additional legal codification is needed. If, however, USAF astronauts are used in a policing role, then the USAF will need an expanded legal regime to allow military forces to perform a role reserved for civil services. Given the wide array of unique missions a space police could perform, the USAF may need additional Title 23, Title 32, and Title 14 authorities. The opening of "highways" in space will likely require a law enforcement mechanism to ensure the safety and protection of commercial participants. Title 23 authority would enable the USAF to fulfill one aspect of its policing role.[185] Title 32 of the United States Code, conversely, governs the National Guard. While there are clear demarcations between civil law enforcement and homeland defense activities here on Earth, in outer space, there are no geographical or political borders, which help make the distinction. Hence, a USAF astronaut police corps may be used both as a guardian of the space merchant fleet and as protector of the Earth as well. Defining specific events requiring such protection lies beyond this work's intent, but the USAF should consider how an astronaut corps comports with the current Title 32 regime. Finally, space policing activities may dictate operating under Title 14 authority, which governs the nation's Coast Guard. Much like the discussion on the National Guard, there exists sufficient legal explanation of the role of the Coast Guard. Some of the legally-defined roles include:

184. Title 10 of the United States Code, titled *Armed Forces*, is the governing law regarding the administration and usage of the United States' armed forces. Conversely, Title 50 pertains to a broad range of security issues (its title is *War and National Defense*). One of the areas that Title 50 covers is the Intelligence Community. Specifically, section 3038 states that "The Secretary of Defense, in carrying out the functions described in this section, may use such elements of the Department of Defense as may be appropriate." In other words, this language enables DoD assets to be used in roles normally associated with the Central Intelligence Agency. See United States Code Title 50, *War and National Defense,* 1 January 2016. Robert Chesney explains some of the issues with the blending of Title 10 and Title 50 authorities. See Robert Chesney, "Military-Intelligence Convergence and the Law of the Title 10/title 50 Debate," *Journal of National Security Law & Policy* 5, (2012): 539.

185. Title 23 of the United States Code is the governing law on national and state highway systems. Authorities under this code would allow the USAF to perform many of the law enforcement duties as currently defined in Title 23. Title 23 is tied with Title 15, *Commerce and Trade*. Accordingly, Title 15 authorities may be required as well to enable space police to interact with outer space commercial activities.

> (1) enforce or assist in the enforcement of all applicable Federal laws on, under, and over the high seas and waters subject to the jurisdiction of the United States
>
> (2) engage in maritime air surveillance or interdiction to enforce or assist in the enforcement of the laws of the United States
>
> (3) administer laws and promulgate and enforce regulations for the promotion of safety of life and property on and under the high seas and waters subject to the jurisdiction of the United States, covering all matters not specifically delegated by law to some other executive department[186]

If the United States and other spacefaring actors define the byways of space as more like the open ocean rather than highways, USAF astronauts will require Title 14 authority to perform the law enforcement aspect of its space policing mission.[187] Building a force filled with steely-eyed professionals, adept at solving a gamut of problems, skilled in adaptation and teamwork, and willing to eschew proven paths to professional success for the unproven, is a critical but not the sole, ingredient in growing a USAF astronaut corps. Senior leaders must nurture the nascent corps and help the USAF's astronauts blaze new paths. The USAF's role in supporting national strategy requires such efforts. Moreover, new infrastructure and legal regimes will be necessary. Constructing an astronaut corps will be groundbreaking. The sheer magnitude will likely rival the building of the Air Corps nearly a century ago.

186. United States Code Title 14, *Coast Guard,* 8 February 2016.9-10.
187. This work does not presume to offer an exhaustive exploration of the legal ramifications of a USAF astronaut corps. These brief examples simply serve as a stepping-off point in the event the Service and nation embark on such a journey.

Chapter 5

A Light Unto One's Path

National safety would be endangered by an Air Force whose doctrines and techniques are tied solely on the equipment and process of the moment. Present equipment is but a step in progress, and any Air Force which does not keep its doctrines ahead of its equipment, and its vision far into the future, can only delude the nation into a false sense of security.

General H.H. "Hap" Arnold

In scientific matters one should never use the word "never"

Wolfgang D. Müller

This Intellectual Journey

Strategy is not always an easily divined concept. Formulating strategy requires asking the right questions. Doing so aids in understanding the contextual influences that necessarily affect the strategic environment. Such an approach is key to posturing the United States in a position of strategic advantage.[495] "Accurate strategic diagnosis is the key to identifying the proper strategic prescription."[496]

Findings and Conclusions

One purpose of this work was to discern the myriad factors of the strategic environment that influence strategy. In shining light into the void of space strategy, the author helped pose the United States in relief. Whether in relief to strategy's requirements, to other nations, or to the reality of space itself, this work accentuated areas where the Air Force and national leaders should focus future efforts.

This work attempted a chiaroscuro, and it illuminated the fact that a national, holistic space strategy does not exist. The focus has trended towards security aspects alone.[497] Pieces of space strategy exist; however, Air Force and national leaders must fill in the gaps. Capability gaps exist between the United States and other nations, but these deficiencies currently stand in the United States' favor. Such an advantage may not always exist, as the author's analysis of Russia and China showed. Both nations view themselves as being in constant competition with the United States.

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495. Andrew F. Krepinevich and Barry D. Watts, *The Last Warrior: Andrew Marshall and the Shaping of Modern American Defense Strategy,* (Santa Monica, CA: Basic Books, 2015), 233.
496. Krepinevich and Watts, *The Last Warrior,* xxii.
497. See Chapters One and Three

What used to be "America's backyard" in space is now increasingly contested by nations who seek larger places in the domain as well.[498]

The investigation of the strategic environment highlighted many areas where USAF astronauts could prove not only useful but necessary. A closer examination, however, revealed that, for many *current space activities*, Airmen astronauts may not be necessary, at least not yet. Manned orbital repair missions seem increasingly unlikely given the on-going developmental efforts toward robotic repair systems.[499] Using astronauts as part of a space weapon system lacks the political backing needed to endure the inevitable démarche from the international community. Moreover, the time to establish such a system may have passed.[500]

How, then, do commercial and private space activities rate? Current civilian space exploration obviates the need for astronauts. The most plausible mission for such astronauts would entail rescue operations, but current exploration efforts are too short-lived to be rescuable.[501] Space mining, as it currently stands, is too immature an industry to justify protecting. Right now, there is nothing to protect. The discussion returns to the central purpose of this work. The purpose was to examine the endogenous and exogenous factors influencing the need, or lack thereof, for a wholly independent USAF astronaut corps. This examination was designed to support or refute the following null hypothesis:

Hypothesis: The United States Air Force does not require a separate astronaut corps.

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498. Erik Seedhouse, *The New Space Race: China vs. USA,* (Chichester, UK: Praxis Publishing, 2010), 223; Eric Heginbotham*, et al.*, *The U.S,-China Military Scorecard: Forces, Geography, and the Evolving Balance of Power, 1996-2017,* (Santa Monica, CA: RAND Corporation, 2015), 344; Jana Honkova, *The Russian Federation's Approach to Military Space and Its Military Space Capabilities,* (Washington, DC: George Marshall Institute, November 2013), 1.
499. "Program Aims to Facilitate Robotic Servicing of Geosynchronous Satellites," DARPA.gov, 25 March 2016, Accessed 13 April 2016, http://www.darpa.mil/news-events/2016-03-25. ; "Satellite Servicing Capabilities Office," NASA, 2016, Accessed 22 February 2016, http://ssco.gsfc.nasa.gov/robotic_refueling_mission.html. ; Martyn Williams, "DARPA Envisages Robotic Satellite Repair Missions," *PC World,* 11 September 2015, http://www.pcworld.com/article/2983657/darpa-envisages-robotic-satellite-repair-missions.html.
500. Everett C. Dolman, "Astropolitik: A Case for Weapons in Space" (Lecture, School of Advanced Air and Space Studies, Maxwell AFB, AL, 7 March 2016).
501. See Chapter Two.

Before initiating this work, the author sensed that the time has not arrived to create a separate USAF astronaut corps. After examining the evidence presented in this work, the author arrives at the following conclusion:

Conclusion 1: There is insufficient evidence to reject the null hypothesis that states, "The United States Air Force does not require a separate astronaut corps."

The "weight of evidence" against the null hypothesis is insufficient.[502] While this examination has not been statistically rigorous, nor could it be, the probability that the author has committed Type II error is small.[503] The current strategic environment obviates the need for USAF astronauts. Alternatively, there is nothing compelling in the current strategic environment for which astronaut Airmen would provide the only tenable strategic option. Material reality does not yet dictate the need for USAF astronauts.

This admission, however, belies an immediacy to the question on astronauts. As stated in the first chapter, failing to reject the null hypothesis is not equivalent to asserting that the USAF will never need an independent astronaut corps. Current conditions do not warrant the commensurate investment of national resources and the likely reaction of other nation-states. The construction of a military astronaut corps may be necessary in the future, but as of this writing, a current requirement does not exist. Chapter 3's theory-based arguments regarding Airmen astronauts, however, revealed certain truths about future requirements and possibilities. Theory-based arguments showed that using astronauts as weapons was an internationally unpalatable prescription to the nation's strategic ailments in space. Space police, on the other hand, if cultivated in concert with confidence-building measures, transparency, and the seeking of cooperation, show great promise. Yet, current space activities do not merit building a guardian class of space police. Commercial efforts,

502. In mathematical parlance, one says that we "fail to reject the null hypothesis."
503. Type II error is what the statistician labels the error of failing to reject the null hypothesis when, in fact, the null hypothesis is incorrect. See Douglas C. Montgomery and George C. Runger, *Applied Statistics and Probability for Engineers,* 2nd ed. (New York, NY: John Wiley and Sons, Inc., 1998), 297-298.

however, if they take root and grow, will likely require a space guard of sorts.[504] Hence, the author posits the following conclusion:

Conclusion 2: An astronaut corps, fulfilling the role of space police or guardians, will likely be required in the future.

Indeed, theory posed no immediate reasons against building a space police force now. It is the material reality of the strategic environment, which prevented this work from rejecting the null hypothesis. With this admission, an important corollary materializes. Even if theory suggests a certain course of action, the proffered solution must accord with material reality. Conversely, as was discussed in chapter 3, even if material reality allowed the author to reject the null hypothesis and state that the USAF required an astronaut corps, the international political consequences could negate any advantage of doing so. In other words, material reality could point to building an astronaut corps while international political theory suggests otherwise. On one hand, theory-based reasoning for astronauts must accord with reality. On the other hand, material reasons are insufficient; the student of strategy must consider the theory-based implications. A necessary and sufficient statement arises.

Conclusion 3: The nation should build a space police force if and only if commercial space developments progress enough to warrant protection. Moreover, constructing a space police force should be done in an open, cooperation-seeking manner among the international community.

Another important observation is worth noting. This work did not comment on whether NASA could or could not fulfill the potential roles and missions posited by the author.[505] Such an investigation was beyond the scope of this study. Moreover, such an investigation may not matter. While NASA astronauts knowingly volunteer to serve on risky missions, they do not serve under an unlimited liability.[506] America's Airmen

504. Brent Ziarnick, *Developing National Power in Space: A Theoretical Model,* (Jefferson City, NC: McFarland, 2015), 102, 143, 152-153.
505. A simple mental exercise suggests that if NASA's mission is to explore space and conduct scientific inquiry for the benefit of all humankind, then a space police role would not comport with the primary mission.
506. Here the author means that NASA astronauts know that each mission carries certain

are different. Each Airman, in raising their hand to defend and protect the nation, knowingly agrees to subsume unlimited liability throughout the performance of their duties. Not every role an Airman performs will require such an assumption of liability, but Airmen as a whole take on this responsibility freely. Whether as space weapons or as space police, the men and women of the USAF are best poised to fulfill these roles with the requisite unlimited liability they may demand.

Furthermore, the USAF already stated that it has a duty to defend civilian space assets. Winston Beauchamp, the Deputy Under Secretary of the Air Force for Space and the director of the Principal Defense Department Space Advisor Staff, stated, ""We have an obligation to provide, not just space resiliency capabilities for our defense space, but for this global commons."[507] Beauchamp elaborated further, "In the same way that we would take action to defend a commercial ship that is threatened by an adversary on the high seas, or a commercial airliner that was threatened by an adversary missile or fighter plane, we must do the same in space."[508] Beauchamp's comments were related to protecting civilian and commercial space assets, which currently means satellites, yet the same responsibility that Beauchamp alluded to could extend to future exploration, mining, and other civil or commercial efforts. Beauchamp's ideas intimate as much. Furthermore, by coupling Beauchamp's ideas with former Chief of Staff, General T. Michael Moseley's comments regarding responsibility to rescue, it seems reasonable that the USAF has already laid the normative groundwork that will give the USAF the moral imperative to protect and defend citizens in space using a space police force.[509]

Conclusion 4: The USAF is best postured to, and should, fulfill the role of a future space police force.

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amounts of risk, but there is low probability they will be actively called upon to sacrifice their life.

507. Phillip Swarts, "US Air Force Will Defend Civilian Space Assets, Official Says," *Air Force Times,* 17 March 2016, http://www.airforcetimes.com/story/military/2016/03/17/us-air-force-defend-civilian-space-assets-official-says/81916264/.

508. Swarts, "US Air Force Will Defend Civilian Space Assets, Official Says," *Air Force Times*.

509. General Moseley stated that the USAF had a moral imperative to rescue American forces. When combining his assertion with Air Force Doctrine on rescue, which includes humanitarian assistance and rescue among other non-traditional missions, the logical outworking suggests that civilian rescue is the moral imperative of the USAF. See T. Michael Moseley, "Memorandum for Combatant Commanders," 26 February 2006.

The fourth conclusion leads to another finding. Specifically, this work's study of astronaut selection revealed the highly-selective qualities needed of astronauts serving in America's civilian space agency. Extrapolating from these historical examples showed no significant difference between civilian astronauts and Airmen astronauts regarding the importance of choosing highly skilled, team-oriented pioneers. NASA ensured it selected only individuals ideally suited for the agency's missions by eschewing massive accession methods in favor of smaller, more rigorous screening systems.[510] Selecting the right individuals, however, was only part of the equation. NASA research showed that selecting well must be accompanied by thorough training programs to maximize team performance.[511] The same will hold true for a future USAF astronaut corps.

Conclusion 5: The most critical subsystems in building a future USAF astronaut corps are the astronauts themselves. Selecting the "right" individuals will require careful processes. Furthermore, the USAF will need to train these people continuously to ensure they are ready to answer the nation's call in space.[512]

The evidence shows that people matter more to the human spaceflight mission than does hardware. Recently, the Chief of Staff, General Mark Welsh, stated at the Air Force Association Conference that the number one thing to remember is that "people matter."[513] Whether this was a reminder to the audience, to the Air Force

510. Many massive accession systems lack rigorous screening methods that ensure all incoming personnel are a good fit for a unit's mission. Consequently, attrition tends to be higher. For NASA, attrition was too costly given the amount of time and resources spent on training an astronaut.
511. A.W. Holland, "Operational Psychology" (Presentation at Decadal Survey in Life and Physical Sciences Space Conference, Irvine, CA, 20 November 2009); National Aeronautics and Space Administration, *Psychology of Space Exploration: Contemporary Research in Historical Perspective,* Douglas A. Vakoch, ed., (Washington, DC: NASA, 2011), 130, 131, 134, 136; National Aeronautics and Space Administration, *Risk of Performance and Behavioral Health Decrements Due to Inadequate Cooperation, Coordination, Communication, and Psychosocial Adaptation Within a Team,* (Washington, DC: NASA, 1 January 2015), 11-19, 25-42; Kelley J. Slack, Al Holland, and Walter Sipes, "Selecting Astronauts: The Role of Psychologists" (Presentation at the 122nd Annual Convention of the American Psychological Association, Washington, DC, 8 August 2014); Kimberly A. Smith-Jentsch*, et al.*, *Training "The Right Stuff": An Assessment of Team Training Needs for Long-Duration Spaceflight Crews,* (Washington, DC: NASA, September 2015), 2.
512. Developing exact selection and training processes for a future astronaut corps is a recommended topic for future study.
513. Hailey Haux, "Welsh Presents AF Update At AFA," AF.mil, 25 February 2016, Accessed 16

enterprise, or a combination, such an admission affirms that the USAF cannot function without people.[514]

Regardless of the audience, these remarks coupled with the research contained herein show that people matter most now and will matter most in building a future astronaut force. The allure of technology and revolutions in military affairs tempts leaders to find panaceas in machines that "may have brought significant change but to an increasingly insignificant phenomenon, like a cure for disease afflicting fewer and fewer people."[515] The strategist must recall the nature of the Clausewitzian duel. People will always be part of war.[516] They are the "domestic machinery of the nation" and the foundation upon which all else is built.[517] The structure, the people, of the military instrument is preeminent in achieving the aims of the political tool.[518]

Despite the realization that people matter most, infrastructure will matter as well. Any effort to cultivate an Airmen astronaut corps will require commensurate spacelift and other hardware capabilities. In turn, acquiring new technologies should invigorate the nation's space industrial base.[519] A revitalized industrial base could

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April 2016, http://www.aetc.af.mil/News/ArticleDisplay/tabid/5115/Article/683520/welsh-presents-af-update-at-afa.aspx.

514. Torey Griffith, "Air Force Prepares to Separate 25,000 in Service's Largest Drawdown," AF.mil, 19 December 2013, Accessed 16 April 2016, http://www.andrews.af.mil/news/story.asp?id=123374963. ; Stephen Losey, "AF Secretary: 18,700 More Airmen Cuts Before it's Over," *Military Times,* 29 May 2014, Accessed 16 April 2016, http://www.militarytimes.com/story/military/archives/2014/05/29/af-secretary-18-700-more-airmen-cuts-before-it-s/78547194/. ; Stephen Losey, "Gen Mark Welsh Sounds Alarm on Undermanned Air Force," *Air Force Times,* 1 December 2015, Accessed 16 April 2016, http://www.airforcetimes.com/story/military/2015/12/01/welsh-sounds-alarm-on-undermanned-air-force/76617202/. In 2013, the USAF announced it needed to cut 25,000 people over the next five years to meet Congressionally-mandated end strength requirements. Later, in 2014, the USAF decided to make all cuts at once because it would be easier on the force. Even later, in December 2015, the Chief of Staff remarked to the Atlantic Council that the USAF was 82 to 85 percent manned leading one reporter to state that the USAF was "on the verge of a total manpower collapse." See L. Todd Wood, "Air Force Gen Mark Welsh: Manpower Shortage Hits 'Virtually Every Mission Area'," *Washington Times,* 4 December 2015, Accessed 16 April 2016, http://www.washingtontimes.com/news/2015/dec/4/l-todd-wood-air-force-gen-mark-welsh-manpower-shor/.

515. Keith L. Shimko, *The Iraq Wars and America's Military Revolution,* (Cambridge, England: Cambridge University Press, 2010), 219.

516. Carl von Clausewitz, *On War,* Reprint ed. trans. Michael Howard and Peter Paret (Princeton, NJ: Princeton University Press, 1989), 75, 89.

517. J. F. C. Fuller, *The Foundations of the Science of War,* (Coconut Creek, FL: Books Express Publishing, 2012), 105.

518. Fuller, *The Foundations of the Science of War,* 82-85.

519. Department of Defense and The Intelligence Community, *National Security Space Strategy (Unclassified Summary),* (Washington, DC: US Government Printing Office, January 2011), 3. It is worth mentioning that the National Security Space Strategy uses data from the satellite

lead to new commercial and private endeavors in space, thus requiring Airmen astronauts. Accordingly, future studies should explore specific ways of constructing the infrastructure for an astronaut corps. A corollary of the third conclusion, however, avoids the tautology of building an astronaut corps to energize industry, which, in turn, justifies an astronaut corps.

Conclusion 6: A USAF astronaut corps will require new infrastructure and hardware. Furthermore, building new technologies should energize the American space industry, which could lead to new requirements for USAF astronauts. Industry must take the first steps. Flag must follow trade resources are scarce.[520]

The seventh and final conclusion of this work is the following:

Conclusion 7: Aside from the obvious Realpolitik power an astronaut force could provide directly, there is an element of soft power in fielding a space police.

This conclusion follows from the discussion on the theory-based analysis in chapter 3. As stated there, human spaceflight and astronauts already wield considerable amounts of soft power.[521] Using astronauts, in an open and internationally-cooperative manner, to police the global commons may be the most effective tool for deescalating the contested and competitive space environment. Certainly, even if soft power is nothing more than sophistry, having space police postures a nation for the harsh reality of the anarchic international order.[522] "We do not currently know whether outer space will reinforce the competitive dimension or create the need for greater cooperation within and among the emerging entities that

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manufacturing industry to support the claim that American technical know-how is at risk. While the data is specific to one sector of the space industry, the American lead is also slipping in another major area, namely spacelift. SpaceX and Blue Origin are working to help staunch the bleeding, but only time will tell if their efforts reinvigorate the nation's spacelift capability.

520. "Air Force Financial Management and Comptroller - Budget," AF.mil, Accessed 16 April 2016, http://www.saffm.hq.af.mil/budget/.

521. Joan Johnson-Freese, *Space as a Strategic Asset,* (New York, NY: Columbia University Press, 2007), 25, 80, 81.

522. Michael W. Doyle, *Ways of War and Peace: Realism, Liberalism, and Socialism,* (New York, NY: W. W. Norton & Company, 1997), 211; Michael V. Smith, "Space Power Course" (Lecture, School of Advanced Air and Space Studies, Maxwell AFB, AL, 11 March 2016).

will populate space. We may hypothesize that the demands of life in outer space may enhance the need for cooperation, but we may also consider the pursuit of clashing interests between contending groups for control of key space geopolitical positions and assets."[523] Possessing a space police force will leave the United States prepared for either eventuality. Moreover, there is a certain amount of prestige inherent in possessing the ability to place members of a nation's populace into space, prestige that can be used to achieve national interests.[524]

Implications

This work's seven conclusions lead to three implications for the reader to consider.

Implication 1: The USAF should prepare now for the potential need to field an Airmen astronaut corps.

Conclusions one through four show that the nation does not need, nor should it build, an astronaut corps now. When the conditions merit doing so, however, the nation should cultivate such a force. Furthermore, the USAF is best postured to fulfill the role of space guardian. A singularity, in effect, exists. It would be imprudent to build an astronaut corps before needed, but when needed, it may be too late given that the lead time for new space technology is significant.[525] Preparation now proves wise. The USAF should not wait to think about the manned space mission until conditions are just right. The USAF, instead, should think about the "conditions that are wrong" which would require Airmen astronauts.[526] "Lead time and proper timing together determine when the progress actually occurs" meaning there is an exact moment when the confluence of conditions will require the efforts of an expectant preparation.[527] The USAF should not squander this lead time. Delay will harm United States' national

523. Robert L. Pfaltzgraff, Jr., "International Relations Theory and Spacepower," in *Towards a Theory of Spacepower*, ed. Peter L Hays, and Charles D Lutes (Washington, DC: National Defense University Press, 2007), 41.
524. Johnson-Freese, *Space as a Strategic Asset,* 55, 56, 80.
525. Claude A. Piantadosi, *Mankind Beyond Earth: The History, Science, and Future of Human Space Exploration,* (New York, NY: Columbia University Press, 2012), 164.
526. Piantadosi, *Mankind Beyond Earth,* 48.
527. Piantadosi, *Mankind Beyond Earth,* 22.

strategy in the form of lost opportunities to exercise hard power or missed chances to increase prestige and soft power.

Implication 2: Beyond planting the seeds for an astronaut corps now, the USAF must cultivate the growth of a future Airmen astronaut force. If the USAF constructs such a corps, senior leaders must create viable career pathways for its future astronauts.

Conclusion five highlighted the need for the careful personnel management of any future astronaut force. Thankfully, the USAF recognizes already the need to help its Airmen blaze new paths. In *A Call to the Future*, senior leaders stated that the USAF "must commit to a career development model that provides those in specialized career fields with incentives and promotion opportunities on par with those in more mainstream disciplines."[528] It is encouraging that senior leaders recognize, at least tacitly, that without a strong personnel system, the USAF will not be prepared to answer the nation's call.

Implication 3: History is replete with the rebukes of the USAF's past attempts at human spaceflight. The USAF should learn from the past and only attempt building an astronaut corps when it can show the mission necessity of such an endeavor.

Chapter 1 highlighted Roy Houchin's account of the USAF's Dyna-Soar program. The project was cancelled, in part, because the USAF could not satisfactorily demonstrate to administration officials the actual mission requirements for the X-20 and what objectives such a program would accomplish that NASA could not.[529] The Manned Orbital Laboratory suffered a similar demise. Stuck in the paradox of not being able to articulate the usefulness of military members in space without first going there, the USAF's "dreams of a military man-in-space presence

528. United States Air Force, *America's Air Force: A Call to the Future,* (Washington, DC: US Government Printing Office, July 2014), 9.
529. Roy F. Houchin, II, *The Rise and Fall of Dyna-Soar, 1944-1963,* (New York, NY: Routledge, 2006), 115, 202-209.

[were] over."[530] In both the Dyna-Soar and the Manned Orbital Laboratory cases, the service could not define explicitly the necessity of creating a space activity that seemingly duplicated NASA's efforts. By being mindful of history's lessons and heeding the third and sixth conclusions of this work, the USAF will be well-placed to articulate why an Airmen astronaut force is needed, which will help counter the inevitable bureaucratic inertia it will face.

Acting upon these three implications will help the USAF posture for the future. In posturing for the future, the USAF must look to history. Indeed, one may only behold the future through the prism of the past. The student of strategy studies history to explicate the past's lessons for application to the present and preparation for the future. Learning from failed attempts at cultivating an astronaut corps will inform the USAF as it prepares to field a future force. The nation can ill-afford to invest resources into new economic sources of power within outer space only to see them lost to the anarchic machinations of the international order. The USAF is the current protector of the United States' civil, commercial, and military, as well as its international partners', space assets. The future will not change that fact. When the space merchant class emerges, a guardian class must accompany. The USAF will be those guardians.

530. David N. Spires, *Beyond Horizons: A Half Century of Air Force Space Leadership,* Revised ed. (Maxwell AFB, AL: Air University Press, 2004), 120-135.

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